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ADDIS ABABA INSTITUTE OF TECHNOLOGY

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

(CONSTRUCTION TECHNOLOGY AND MANAGEMENT STREAM)

STUDY ON RISK MANAGEMENT PRACTICE IN SELECTED ADDIS ABABA 10/90 & 20/80 CONDOMINIUM PROJECTS

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MEng. Project Submitted to School of Graduate Studies of Addis Ababa University in partial fulfillment of the requirements for the degree of Masters of Engineering in Civil Engineering (Construction Technology and Management)

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By

Kalkidan Fisseha

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Declaration

I hereby declare that this MEng. Thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this Thesis have been duly acknowledged.

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LIST OF ABBREVIATIONS

AAHCPO	Addis Ababa Housing Construction Project Office
AAHDPO	Addis Ababa Housing Development Program Office
AAIHDP	Addis Ababa Integrated Housing Development Program
APM	Association for Project Management
CBE	Commercial Bank of Ethiopia
CPI	Cost Performance Index
CSA	Central Statistical Agency
GTZ	German Technical Corporation
IHDP	Integrated Housing Development Program
MSEs	Middle and Small Enterprises
MoWUD	Ministry of Works and Urban Development
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMP	Project Management Plan
SPI	Schedule Performance Index

ABSTRACT

The research deals with the assessment of risk management practice in selected Addis Ababa 10/90 and 20/80 condominium projects. The objectives of the research was to identify risk management practice in Addis Ababa condominium projects, to identify the key risks causing cost overrun, time overrun and quality deviation in Addis Ababa condominium housing projects and to assess appropriateness of risk allocation practices based on feedbacks from stakeholders

Different literatures were assessed and reviewed to indicate risk management is important management practice for the success of the project. Questionnaire and unstructured interview were taken from construction companies and consulting firms whom performed on selected Addis Ababa 10/90 and 20/80 condominium projects. Also the client, Addis Ababa Housing Development is surveyed through questionnaire and unstructured interview.

The research findings indicate most of the parties performed in Addis Ababa condominium projects acknowledged the benefits of risk management but still there is lack of formal risk management. The method used to deal with risks in Addis Ababa condominium projects is informal way which is highly dependent on individual judgment and past experience. This is mainly because of lack of awareness, familiarity and knowledge about risk management among the professionals in the industry. It was also observed the top ten risks causing time overrun, cost overrun and quality deviation in Addis Ababa condominium projects are construction, finance, political and logistics related risks. In addition, the research revealed the consequence of the risks because of inadequate management and planning should not be the contractor's risk only since most of construction materials are provided by the client. It is also believed by the majority of parties involved in Addis Ababa condominium projects that formal risk management can reduce the consequence of risks.

In response to the finding recommendation is raised to implement well established risk management system by the stakeholders so that the objectives will be attained, materials for the construction Works to be provided by the contractor due to the vastness of the projects, the owner or the government bodies to aid research and development centers so that the centers will discover cost reducing construction materials so that the imported construction materials will be reduced.

Keywords: Condominium, Risk, Management, Project and Objectives.

CHAPTER ONE
INTRODUCTION

1.1. Background

Ethiopia is an ancient country with a history of over 3,000 years and a population of above 110 million, is located in the horn of Africa, covering an area of 1.13 million square km. Addis Ababa, the capital city alone accommodates near to 30% of the urban population of the country. Addis Ababa is the growth engine for Ethiopia and a major pillar in the country's vision to become a middle-income, carbon-neutral, and resilient economy by 2025(GPSURR, 2015, p.25). Addis Ababa's economy is growing annually by 14%. The city alone currently contributes approximately 50% towards the national GDP, highlighting its strategic role within the overall economic development of the country. Addis is expanding in a sprawling manner with growth in urban extent outpacing population growth. The city center has extremely high density (up to 30,000 people per km), concentrating around 30% of the population on 8% of the land, generally with poor living conditions (2015, GPSURR, p.25). According to CSA 29.1% of the population is below the national poverty line, 46.4% is multidimensional poor (2016, African economic outlook p,4). Mekonnen (2007) found out that the development of affordable housing for the low-income groups in the city is the challenging issues because of the scarcity of land and high cost of building materials. In general, the affordability of housing is an important subject for Ethiopia, and it has received considerable recent public attention (Muluye Tarekegn, 2015).

In response to this challenge, the Ethiopian government outlined an ambitious vision for low-income urban and housing development, formulated as the Integrated Housing Development Program (IHDP), for all slums to be cleared within ten years, and for Ethiopia to be a middle income country by the year 2025. (United Nations Human Settlements Program, 2011). Since 2004, the government has been implementing the program to solve the country's urban housing shortage at country level. The program was launched in 2004 (1996 in the Ethiopian calendar) by State Minister Arkebe Equbay, then the Mayor of Addis Ababa (UN-HABITAT, 2011). His main goal was to build low-cost housing in Addis Ababa. He made a proposal to the German Technical Corporation (GTZ) office to which they responded by setting up an office in Addis Ababa (UNHABITAT, 2010) and the city administration has undertaken a pilot project, which constitute the construction of 700 housing units to test the effectiveness of the program. After the successful completion of the pilot project, the

programme has been scaled-up to its full scale and become one of the major tasks of the city administration in each fiscal year (Solomon k. 2014). The pilot project consisted of 700 residential units along with office and commercial units. GTZ managed the project on behalf of the city government and the project was extremely successful in terms of cost and time. When the government suggested building above 40,000 houses every year, GTZ declined to continue their direct involvement with project design and implementation, instead taking an advisory role. To achieve such ambitious targets, GTZ recommended that the government to create a new office specifically for housing development, which they did in 2005 by establishing the Addis Ababa Housing Development Project Office (AAHDPO) (UN-HABITAT, 2010).

At initial implementation stage, the capital city, Addis Ababa had given priority to the housing construction program due to high demand for housing in the capital city. The program has been addressed through Addis Ababa Integrated Housing Development Program (AAIHDP) with the aim of solving housing shortage in the city by mass construction of low cost houses. The owner of the projects is Ministry of Works and Urban Development (MWoUD) under, which the Addis Ababa housing construction project office (for 20/80 and 10/90 projects) given the responsibility for managing and administration the projects jointly with assistance of consulting firms engaged in the projects as supervisors.

The source of finance for AAIHDP are bank loan, city budget and down payments from beneficiaries of the project. Up to 30thJune 2016 about 32. 87 billion Ethiopian birr loans disbursed to the project office by CBE from these amount 13.38 billion Ethiopian birr loan and 3 billion Ethiopian birr interests are collected. Out of total disbursed amount, unpaid loan and unpaid interest are 19.49 billion Ethiopian birr and 95.38 million Ethiopian birr respectively.

However, housing deficit is still a problem in Addis Ababa after fifteen years of execution of the program. In the last two registration program 2005 and 2013 about 974,835 residents were registered for the condominium houses, within 15 years only 233,575 houses are constructed and transferred to beneficiaries. According to recent study, the office needs 55 years to access the condominium houses for all the registered dwells' (Addis Zemen News Letter 76th Year, No.172). In addition to this, criticism also made on the un-affordability of the houses to low income residents and on quality issues as per UN-HABITAT, 2011 report.

Thus, the projects objectives un-attainment is due to a number of risk factors that have not been properly taken into consideration in the project planning and implementation stage. According to different literatures risk in construction is the uncertainty involved in construction projects that causes cost overrun, time overrun and lack of quality during the progression of the projects and at their end. So it is necessary to assess risk management mechanisms practiced in Addis Ababa Condominium projects, in order to assist the projects meets its objectives.

1.2 Statement of the Problem

The Integrated Housing Development Program me (IHDP) later become Addis Ababa Housing Construction Project office AAHCP's initial goal was to construct 400,000 units within 5years (UNHABITAT, 2011: Vii). However, the project office up to March, 2019 constructed and transferred only 233,575 condominium houses. This shows the project office couldn't construct the condominium houses as per the schedule. According to the project office Planning and budget department, the project office are planning to construct the houses within 18 months but practically the project office are taking more than 36 months or more than 3 and 4 years. This is an indication there is a huge gap between planned time and completion of the construction projects.

As per the data taken from project office Planning and budget department, the first aim of the program is to sell the houses by 2,000 ETB /m2 for end users but now it has increased to 4,643.75 ETB /m2. On other hand it is believed that the household housing expenditure is considered as affordable if it is not greater than 30% of the total income. But the condominium that are constructed by AAHCPO have increased their selling price at an alarmingly rate without proportionate rate of the target groups income. When we compare the change in condominium house costs related to change in income of the civil servant within the last 13 rounds, there is great disparity.

According to Yimenu (2016) study carried out on AAHCPO cost performance index (CPI) of AAHCPO shows that, AAHCPO experiencing 21% cost overrun and Schedule performance index (SPI) indicates 67 % delay in construction schedule. This show AAHCPO is consuming more money and time than planned budget and time.

In addition to the above UN-Habitat reports in 2011 specifies quality of houses is highly compromised to the extent that housing units might not reach the expected life span of hundred years

The above discussion leads to the major concern regarding whether the risk factors in housing project undertakings has been well investigated, and if so, the question is whether risk factors have been given serious consideration by the housing sector's players.

Hence, failure of condominium houses to meet their objectives because of cost and time overrun in addition to undermined quality are an indication of problems related to lack of proper risk management that will be addressed in detail in the research work.

1.3 Objective of the Research

The general objective of this project is to study how risk management is currently practiced in Addis Ababa 10/90 and 20/80 condominium housing projects and to emphasize the importance of risk management.

The specific objectives are:

- To identify risk management practice in 10/90 and 20/80 Addis Ababa condominium projects
- To identify the key risks causing cost overrun, time overrun and quality deviation in 10//90 and 20/80 Addis Ababa condominium housing projects
- To assess appropriateness of risk allocation practices based on feedbacks from stakeholders of 10//90 and 20/80 Addis Ababa condominium housing projects
- To propose practical recommendation based on research findings on how to improve risk management strategies in Addis Ababa condominium housing projects.

1.4 Research Questions

The research will answer the following questions:

- How risk management is currently practiced in 10//90 and 20/80 Addis Ababa condominium housing projects?
- What are the key risks influencing the achievement of 10//90 and 20/80 Addis Ababa condominium projects causing cost overrun, time overrun and quality deviations?

- How risks are allocated and its appropriateness based on feedbacks from stakeholders?
- What should be done to improve the risk management practice of 10//90 and 20/80 Addis Ababa condominium projects?

1.5 Significance of the Study

The research will have the advantage of assessing risk management practices in Addis Ababa condominium projects and pointing out the key risks causing cost overrun, time overrun and quality deviations that will at the end provide mechanisms for better way of managing those risks. More specifically, the project work has the following major significance:

- Assists stakeholders in identifying the major causes of why condominium projects are not meeting their objectives in Addis Ababa
- It helps concerned governmental institutions to see where the gap for improvement is and locate area of interventions
- It might also serve for further studies on the area and especially for researchers who are planning to study challenges of condominium construction in Ethiopia in general or in Addis Ababa to specific.

1.6 Scope of the Research

The research focused on assessment of risk management practices within Addis Ababa condominium housing project and identification of risks causing time overrun, cost overrun and quality deviations. Also, based on stakeholder's feedback the research assessed the appropriateness of risk allocation practice in Addis Ababa 10/90 and 20/80 condominium projects.

The research is limited to Client, Contractors and Consultants who have direct involvement in condominium housing projects in Addis Ababa. The research is not addressed subcontractors, small and middle enterprises, suppliers, end users and other stakeholders due to vastness of the topic to be assessed within the scope of this research work.

1.7 Research Process

The research process commenced with problem identification through unstructured literature review and informal discussions with professionals in the sector and also with my advisor. Once after problem identification, a conceptual literature review was carried out to have an

in-depth understanding on what are the basic elements of risk management, risk factors that cause time overrun, cost overrun and quality deviation and risk allocation mechanisms. The literature review includes books, dissertation, journals and citation etc. Besides this, a questionnaire survey and unstructured interview is conducted to strengthen the study. The questionnaire was distributed to contractor, consultant and clients. Then, inspection and cataloguing of data were done and analyzed using different statistical tools. Finally, from the analysis of result and brief discussion; conclusions and recommendations are forwarded.

1.8 Organization of Research Work

The research study is divided into chapters, the first chapter discusses on general introduction, background of the study, statement of the problem, objectives, scope, methodology adapted to achieve the objectives of the study and organization of the research work. In the second chapter the basic elements of risk management, risk factors that because time overrun, cost overrun and quality deviation and risk allocation mechanisms were discussed. Chapter three described the research methodology followed in order to achieve the objectives of the study. Chapter four discussed and analyzed the data obtained from the questionnaire survey and unstructured interview. Finally the last chapter is conclusion and recommendation based on the research findings.

CHAPTER TWO
LITERATURE REVIEW

The literature review which is one of the section of this research comprises of a description of some of the different publications which have attempted to document a compendium of relevant information concerning project management, risk management, causes of risks resulting in alteration of project cost, time and quality and impact of risk on project cost, time and quality.

2.1 Overview of Project ad its Lifecycle

Since risk management is one division of the whole project management process it has been found necessary first to know about Project life cycle, Project Management, and Construction project with elaboration of its definition and concept.

In defining a project, Larson and Gray (2011) described it as a non-permanent venture carried out to create a specific outcome of product, service, or results and it's characterized by the following: A set objective, time constraint, budget constraint, desired performance criteria, and engagement of distinct sectors and professionals.

Kerzner (2001) on the other hand describes a Project as a chain of activities with a set start and close date that holds a specific objective to be realized within the constraint of time, cost, and resources.

A project has a life cycle that defines how it begins and ends. The stages of the project life cycle vary depending on the source of the classifications or groupings. Larson and Gray, (2011) described the stages to include the following: Defining stage, Planning stage, Executing stage and Closing stage.

PMI (2004), illustrated five stages of the project life cycle as seen in Figure 1.It is worth noting that the monitoring and controlling captured with the PMI (2004) has been fused with the executing stage in the case of Larson and Gay (2011).

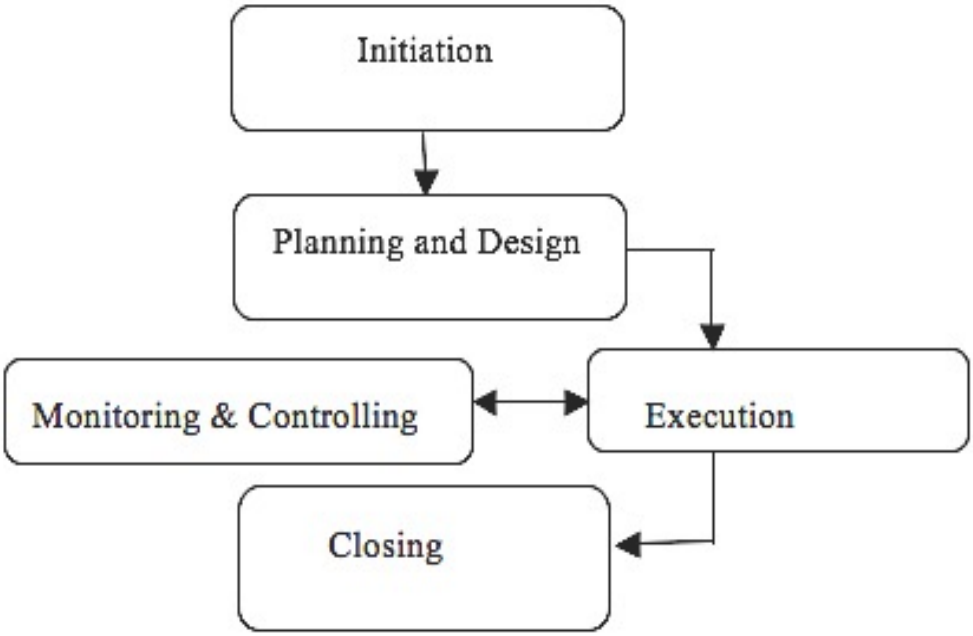

Figure 1. Construction Project life cycle, Source: (PMI, 2004)

Initiation Stage: This stage sets out the initial range of the project taking into consideration the environment and integrates the needed resources using Preliminary Scope Statement. Mainly consist of the key constraints such as cost, tasks and time schedule. Also includes the contract documentation, list of required equipment and required budget for the project. (PMI, 2004).

Planning and design Stage: The aim of this stage is to illustrate the management of the project through the rest of the stages. During this stage, tasks are defined, the sequence of operations set out and the needed resources determined against the various grouped activities. It makes sure that a project meets its target and can be fulfilled within the identified constraints of the project which may include duration and budgetary limitations (PMI, 2004).

Execution Stage: This is the implementation phase of the project. The activities that have been defined in the Project Management Plan (PMP) are done in pursue of realizing the project objective. This also takes into account integrating activities and the coordination involved mainly of people and other resources to achieve the desired outcome as outlined in the Project Management Plan (PMI, 2004).

Monitoring and Controlling Stage: This stage mainly involve review of the progress in the project execution phase with the sole purpose of identifying execution challenges and to

strike actions to rectify problems. This stage takes into account tasks that are still being done, the actual cost in executing the tasks, the duration within which the tasks have been carried out, and the effort invested in these tasks. All these are compared against the budgeted cost, estimated time and the expected output rate as indicated in the Project Management Plan. This stage also takes a closer view of the Project Performance Baseline, assess risks and set up corrective actions (PMI, 2004).

Closing Stage: This stage is the phase at which the completed project is officially handed over to the client with a formal acceptance. Tasks across the project are completed and certified at this stage, and contracts relevant to the project is finalized and closed out (PMI, 2004).

2.2 Construction Projects

A construction project is defined as a physical structure that is initiated by the designers' drawings and gets transformed into finished product through a set of methods and processes (Levy, 2000). Executing a construction project is defined as a process of putting up an infrastructure. Extensive planning is the key for a project to be executed successfully. Before the construction execution phase begins, the design together with the budgeted cost and timelines will have to be completed and approved (Clough, 1999). According to Levy, (2000) for construction projects to be successful and achieve the set objective, the following key criteria must be met: Complete Project within the estimated time, Actual cost in executing the project is not more than the budgeted cost of project, The project should be claims/disputes free during and beyond the project lifecycle, Good working rapport between Contractors and other stakeholders and The output of work meets the desired quality.

Construction projects have different stakeholders involved in it, but the following are the key players or participants:

Clients: They provide the financial resources needed for construction projects. The client's expectation is to receive the completed project within the budgeted cost and estimated time (Altoryman, 2014).

Consultants: These professionals are chosen by the client to represent and protect the interest of the client. They are resourced and backed by their professional expertise.

They consultant may be a group of Designers or Specialist Engineers.

The client seeks and receives advice on various section of the project from the consultants and in doing so, the consultants put in place management practices to take care of risks arising from incorrect advice which may lead to claims and disputes (Altoryman, 2014).

Contractors: They are responsible for the execution of the designed work and their product ranges from a building to varying form of construction unit. Contractors work to maximized profit from any project. Examples of contractors are: main contractors, subcontractors (Altoryman, 2014).

Usually, the inability of a Contractor to achieve the project objective of completing it within the budgeted cost and estimated time duration and required specifications may be as a result of ineffective management practices (Flanagan, 1993). The main linkage of claims and disputes is traced to the disruptions and delays in Contractor's progress (Braimah and Ndekugri, 2008). Construction projects are grouped into four categories (Gloud, 1997): Residential construction, Construction for businesses, Infrastructure and heavy construction and Industrial construction projects. Gloud (1997), related that construction projects are deemed technically sophisticated than others, and client preferences determine the responsibility of the field of construction management. That means that the clients choose whether a consultant firm or a contractor firm is responsible for managing the construction projects.

2.3 Nature of the Housing Sector and its Problems

Housing, as many people may perceive it, does not mean shelter only, it means more than that. Housing is one of the basic necessities for human survival. It has manifold social, economic, and cultural implications beyond the basic functional aspect of shelter. As UN Habitat (2010 b) defines housing is the living environment, which protects man from harsh physical and social conditions, neighbourhood, the physical structure and, all services and facilities needed for the physical and social well-being of the family or the individual. This definition implies that the concept of housing includes, in addition to the dwelling shelter, accessory physical and social infrastructures as well as neighbourhood social networks that have implications on the social, political and cultural lives of households. In a broad sense, housing indicates the welfare and quality of life of a society as one can judge the life standards of a society by looking at the housing structure and condition of that society. From economic point of view, houses are stable assets that form 20 to 50 percent of the

reproducible wealth in most countries (Dejene, 2007). Further; housing is intimately related with family life and is a pillar of household satisfaction and social stability. The housing sector is thus an integral part of the overall economy of societies rather than limited to the issue of social welfare (Solomon, 2005)

2.4 Low Income Housing in Ethiopia

Poor households face the greatest challenges with getting decent housing they can afford. For a poor family with monthly income of less than 500 Birr it is difficult to afford even a room rent of 100 Birr, Martha (2006). The government has limited options for assisting the very poorest households; a broader number of policies may help working poor people employed in the informal sector to gain a stable adequate housing. Several policies already enumerated in this strategy could work to facilitate housing for the working poor, Martha (2007). Governments in high income countries place a great emphasis on directly assisting housing for low income people, often through demand-side subsidies such as vouchers that pay a portion of monthly housing cost for poor families. In a low income country, such a policy is difficult to sustain for two reasons: there is a huge potential demand for housing subsidy because so many people are poor, and government financial resources are very limited. Policies to either offer vouchers or directly construct and subsidize new housing are very expensive. The menu of recommended options discussed below are lower cost approaches that could work better in Ethiopia, building on many recommendations contained in earlier sections of this strategy, Martha (2007).

2.5 Policy and Legal Frameworks Related to Housing

Since 1991 Ethiopia has had a decentralized regulatory structure with considerable autonomy devolved to regional states regarding the management of their internal affairs. The country is divided into nine states (Kilils) and two autonomous administrative areas, the cities of Addis Ababa and Dire Dawa. Each state comprises zones, districts (Woreda), cities, and neighbourhood administrations (Kebeles). In each region the districts are the basic planning unit and have jurisdiction over the kebeles. The capital city of Addis Ababa has ten sub-city administrations, 114 woredas. All land is property of the national government and is leased, not sold, for development. Until recently, there were few national coordination policies regarding housing and urban development. In 2005, the Council of Ministers of the Federal Democratic Republic of Ethiopia formulated and approved a consolidated Urban

Development Policy to link together the small-scale efforts made by regional governments and cities since 2000. They also created the national Ministry of Works and Urban Development (MWUD) to guide the overall development of the country' s urban areas and conducting studies on its urbanization patterns . Within MWUD, the National Urban Planning Institute is responsible for preparing physical urban development plans, the Housing Development Bureau works towards the implementation of the IHDP including the MSE Development Program, the Urban Development Support Services deal with financial planning, human resources, and capacity building.

2.6 The Vision of the Integrated Housing Development Program

The preceding sections have demonstrated the significant challenges facing the Ethiopian housing sector. Sustained high urbanization and population rates will put extra pressure on already failing and deteriorated urban infrastructure, services, and housing stock. The massive housing needs are unlikely to be met by the small scale housing cooperative, government, and upgrading. In response to this challenge, the Ethiopian government outlined an ambitious vision for low-income urban and housing development, formulated as the Integrated Housing Development program (IHDP), for all slums to be cleared within ten years' time and for Ethiopia to be a middle-income country by 2025. In particular: 'The IHDP envisage the program of housing as an instrument to promote urban development, create jobs, revitalize the local urban economy through MSE development, encourage saving and empower urban residents through property ownership, and develop the capacity of the domestic construction industry.'

2.7 The Integrated Housing Development Program

2.7.1 Overview, Origins and Significance of the Program

The Integrated Housing Development Program (IHDP) is a government-led and financed housing provision program for low-and middle-income households in Ethiopia. The program was launched in 2004. Within the IHDP, specific projects are undertaken on either brown field sites or slum areas that are cleared and residents re-housed. The common attribute of each project is the type of housing developed, condominium housing: multi-storied housing units for several households where communal areas are jointly owned and managed. The IHDP has impressive targets. The mandate of the IHDP is to reduce slum areas in the city by 50 per cent and address and improve the unemployment percentage in the capital within five

years, through the building of nearly 400,000 new units nationally. As of mid-2010, the government had built a total of 80,257 housing units in Addis Ababa.

2.7.2 Significance of the program

The Ethiopian Integrated Housing Development Program is an ambitious program that directly addresses the pressing low-income housing challenge. The program is significant for four principal reasons.

(a) Large scale

The program is a large-scale approach to addressing the current housing deficit, the poor quality of the existing housing stock, and the future housing needs due to continued urbanization. Ethiopia is one of few countries in Africa that has recently implemented a program at such an ambitious scale. The large scale contrasts the prevailing approach of small-scale project based slum upgrading and housing cooperative schemes.

(b) Pro-poor

The program allows low- and middle-income households, who typically live in precarious housing situations to access improved housing. Through the construction of durable, fully serviced housing units the program greatly improves their living conditions, security of tenure, and access to basic services. Importantly, the program has facilitated access to credit for the low-income sector of the population, through the Commercial Bank of Ethiopia, where previously there was very limited opportunity for low-income households to secure credit for improved housing.

(c) Slum prevention and access to homeownership

The program marks a radical departure from previous government-owned rental housing approaches to that of private homeownership. The program highlights government and local authority commitment to addressing housing affordability for the low-income sector of the population, improving the living conditions of the low-income urban dwellers and reduces urban slum prevalence rates in Ethiopia.

(d) Integrated approach to housing and economic development

The program recognizes the opportunity for housing to stimulate the economy, create employment, and improve the capacity of the construction and financial sectors. The adoption of cost-effective construction techniques and systems, notably pre-cast concrete

elements, have reduced construction costs (by up to 30 per cent) compared with conventional systems, improved the speed of construction, and facilitated the development of small and medium enterprises to produce construction elements.

2.8 Project Management Processes

Owing to the complex nature of projects, various projects may demand resources differently. For effective management of the complex nature of projects, there is the need to break down the project into separate interconnected parts capable of being handled by the manager as Walker, (2000) mentioned. Hillson, (2002) agreed that a system approach is required to handle the separate constituents of a project.

There exist 10 project management areas designed to offer a helping hand in handling the separate constituents of a project which are listed below (PMI, 2013): Project integration management, Project scope management, Project time management, Project cost management, Project quality management, Project human resources management, Project communications management, Project risk management and Project procurement management and Project Stakeholders Management.

These 10 knowledge areas are critical for the successful completion of projects. However, this study concentrates on risk management and the subsequent sections and sub-sections will elaborate more on it.

Risk management is probably the most difficult aspect of project management. A project manager must be able to recognize and identify the root causes of risks and to trace these causes through the project to their consequences. Frequent delays and cost overruns on a lot of projects are some of the challenges of the construction industry despite its contribution to economic development and growth (Frimpong et al., 2003).There is the need for serious measures and the right risk management processes to be put in place to prevent these cost overruns and delays as opined by Ahadzie et al. (2008), who observed that overall project cost and quality should be viewed as the most important criteria of success in the project

2.9 Definition of Risk: Risk Overview

Oxford English Dictionary cites the earliest use of the word ‘risk’ in English (in the spelling of risqué from French original, 'risqué') as of 1621, and the spelling as risk from 1655. It defines risk as a situation involving exposure to danger or the possibility that something

unpleasant will happen. Webster dictionary defines risk as "the possibility of loss, injury, disadvantages, or destruction''. (Osipova 2008), Risks are uncertain events or conditions that may have an impact on one or several project objectives

(Jaffari, 2001) defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartamhas defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment.

Risk can be defined as the combination of the probability of an event and its consequences (ISO/IEC Guide 73)(IEC 2001).Guides published by the US Project Management Institute (PMI) defines risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective (PMI, 2000), and the UK Association for Project Management (APM) defines risk as an uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of the project's objective (APM, 1997). Both have adopted a broad view of risk in terms of threats and opportunities.

A risk is defined as the potential for complications and problems with respect to the completion of a project and the achievement of a project goal (Mark et al., 2004) and as an uncertain future event or condition with the occurrence rate of greater than 0% but less than 100% that has an effect on at least one of project objectives (i.e., scope, schedule, cost, or quality, etc.). In addition, the impact or consequences of this future event must be unexpected or unplanned (Chia, 2006). Uncertainty becomes risk if it is quantifiable or probability is assigned to it (Carlsson et al., 2005) and (Knight, 1921) and every uncertainty is not a risk while risk is always uncertain (Hillson D., 2009).

Uncertainty is a situation in which a number of possibilities exist and which of them has occurred, or will occur, is unknown. Considering all risks are uncertain but not all uncertainty is risky (Yoe, 2000). Certainty exists only when one can specify exactly what will happen during the period that covered by the decision. This is not very common in the construction industry (Flanagan & Norman, 1993). Other writers see no difference between risk and uncertainty; Education and Learning Wales (2001) stated that risk and uncertainty can be defined as follows:

- Risk exists when a decision is expressed in terms of range of possible outcomes and when known probabilities can be attached to the outcomes.

- Uncertainty exists when there is more than one possible outcome of a course of action but the probability of each outcome is unknown.

For risk to occur, the main dependent is probability which could be expressed quantitatively. Uncertainty, however, might be defined as a situation in which there are no historic data or previous history related to the situation being considered by the decision maker. Risk is an element subjected to empirical measurement, while uncertainty is of a non-quantifiable type as stated in the findings of a research conducted by ADB (2002). Thus, a situation where there are indications of its likelihood of the realized value of a fallen variable within stated limits is risk related and can be described by the fluctuations around the average of a probability calculus. If the fluctuations of a variable are such that they cannot be described by a probability calculus, the situation is described as uncertainty. Greene (2001) viewed risk as the probability an adverse event that occurs during a stipulated time period, or results from a particular challenge.

Many people use hazard and risk interchangeably and sometimes confused each other (Bunni, 2003). “Hazard is defined as the potential that have adverse consequence, whereas, risk is defined as the combination of hazard and its probability of occurrence” (Edwards, 1995). Risk can be defined as the product of the probability and the eventual impact of a hazard (Smallman, 2000). Fariex (2007) Risk is a factor, thing, element or course involving uncertain danger or a hazard. In other words, risk is the product of the probability or likelihood of an undesired event.

Regarding risk literatures offer different definitions of project risk (Baloi and Price 2003, Barber 2005, Chapman and Ward 2002, Flanagan and Norman 1993, IEC 2001, Jaafari 2001, PMI 2000, Smith et al. 2006). Several of these definitions have a common feature: they define risk in terms of uncertain events and their impact on a project’s objectives.

In addition to the different definitions of risk, there are various ways for categorizing risk for different purposes too. For example, some categorize risks in construction projects broadly into external risks and internal risks while others classify risk in more detailed categories of political risk, financial risk, market risk, intellectual property risk, social risk, safety risk, etc (Songer et al., 1997). Internal risks are things that the project team can control or influence such as staff assignments and cost estimates. External risks are things beyond the control or influence of the project team such as market shifts or government actions (PMBOK Guide).

Further PMBOK® Guide categorizes risk into such groups: technical, external, organizational, environmental, or project management.

There are many approaches in literature for construction risk classification. Perry & Hayes (1985) give an extensive list of factors assembled from several sources, and classified in terms of risks retainable by contractors, consultants and clients. Abdou (1996) classified construction risks into three groups, i.e. construction finance, construction time and construction design. Chapman (2001) grouped risks into four subsets: environment, industry, client and project. Shen (2001) categorized them into six groups in accordance with the nature of the risks, i.e. financial, legal, management, market, policy and political. Chen et al. (2004) proposed 15 risks concern with project cost and divided them into three groups: resource factors, management factors and parent factors. Zeng et al. (2007) classified risk factors as human, site, material and equipment factors.

The source of risk includes inherent uncertainties and issues relative to company's fluctuating profit margin, competitive bidding process, weather change, job-site productivity, the political situations, inflation, contractual rights, and market competition, etc. (Karimiazari et al., 2011).

There exists no comprehensive study explaining the causes of risks among construction companies, moreover research covering the subject matter has tended to identify the symptoms rather than causes, a number of authors have attempted in their studies to ascertain the causes of threats in the construction industry, Kangari (cited in Rwelamila & Lobelo, 1997) ascribed the high threats to: A highly fragmented industry, Industry highly sensitive to economic cycles, Fierce competition as result of an over-capacitated market, Relative ease of entry, Management problems, Trading including (Competitive quoting, Outsize projects, High gearing, Resistance to change),Accounting, where inconsistencies occur in the financial data generated for management, Increase in project size, Unfamiliarity with new geographic area, moving into new type of construction and Change in key personnel.

Risk is not always related to the potential result in loss only. There are researches regarded risk as potential result in loss and gain (Perry and Heys, 1985) and Webe (2003) risk exposures can be valued either positively or negatively. Sometimes risks are seen as an opportunity for the party who has knowledge and experience how to handle it. However, Ward and Chapman (2003) argue that the term 'risk' is often associated with adversity and

focus on threats, not opportunities. The questionnaire survey conducted by Akintoye and MacLeod (1997) strengthens the argument, showing that the majority of respondents perceive risk as a negative event. This paper mainly focused on risks that have negative out comes. Risk is difficult to deal with, and this requires a proper management framework both of theoretical and practical meanings.

2. 10 Risk Management

Project risk management, which has been practiced since the mid-1980s, is one of the nine main knowledge areas of the project management institute's project management body of knowledge (Tuysz et al., 2006). The major role of risk management is to reduce the negative effect of as many risks as possible but not to remove all the project risks since it not practical (Bunni, 2003). In the global sense, risk management is the process that, when carried out, ensures that all that can be done will be done to achieve the objective of the project, within the constraints of the project (Clark, Pledger and Needler, 1990). The basic goal of project management is to realize the project within the predicted time, planned costs and satisfactory quality. Contrary to this is project realization under conditions of uncertainty, and when the outcomes of all foreseen events cannot be predicted with certainty. This is what makes it necessary to turn uncertainty into risk, and to manage that risk. In this way, decisions based on insufficient information can be avoided, and this will lead to better overall performance.

Risk management is a formal and orderly process of systematically identifying, analyzing, and responding to risks throughout the life-cycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control. The risk management process aims to identify and assess risks in order to enable the risks to be clearly understood and managed effectively (Hillson 2002 b). Significant improvement to construction project management performance may be achieved from adopting the process of risk management (Flanagan and Norman, 1993).

According to PMBOK (2008) risk management is the systematic process of identifying, analyzing, and responding to project risks. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives and is divided into six steps: planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, and risk monitoring and control. Risk Management covers the process of identification, assessment,

allocation, and management of all project risks (APM, 2000). Douglas (2009) said managing risks is involved in identifying, assessing and prioritizing risks by monitoring, controlling, and applying managerial resources with a coordinated and economical effort so as to minimize the probability and/or impact of unfortunate events and so as to maximize the realization of project objectives.

Cooper et al. (2005) explains risk management process involves the systematic application of management policies, processes and procedures to the tasks of establishing the context, identifying, analyzing, treating, monitoring and communicating risks. Risk management process is the basic principle of understanding and managing risks in a project. It consists of the main phases: identification, assessment and analysis, and response (Smith et al. 2006).

Risk management is defined as the process of identifying and assessing risk, and to apply methods to reduce it to an acceptable extent (Tohidi, 2011). Then, the main purpose of project's risk management is to identify, evaluate, and control the risk for project success (Lee et al, 2009). Overall, risk management process includes the following main steps: Risk planning, Risk identification, Risk assessment (qualitative and quantitative), Risk analysis, Risk response, Risk monitoring and Recording the risk management process (ISO 31.000, 2009; Baloi and Price, 2003)

The international standard "Project risk management – Application guidelines" (IEC 2001) offers a model with four steps: risk identification, risk assessment, risk treatment, and risk review and monitoring. Baloi and Price (2003) include an additional step of risk communication. Chapman and Ward (2003) present framework which involves nine stages: define the project, focus the project, identify the issues, structure the issues, clarify ownership, estimate variability, evaluate implication, harness the plans, and manage implementation. A research done by Cristian P. et al, (2009), says risk management is comprised of four steps which contain risk identification, risk analysis, risk response and risk controlling.

According to Perry and Hayes (1985), the risk management process consists of three phases: risk identification, risk analysis, risk response. However, any activity undertaken as a risk response may produce new risks, which should be in their turn be identified, analyzed and responded to. Thus some authors view risk management as a cyclical process. Carter et al. (1994), the risk management process consists of 6 phases that cyclically repeat themselves.

Risk identification and documentation; Risk quantification and classification; Risk modeling (often called risk analysis); Risk reporting and strategy development; Risk mitigation, reduction and/or optimization; and Risk monitoring and control

Kliem and Ludin (1997) divided the risk management process into 4 phases, Risk identification; Risk analysis; Risk control; Risk reporting. Baker, Ponniah and Smith (1998) divided the risk management process into five phases: risk identification, risk estimation, risk evaluation, risk response and risk monitoring.

Despite the variety of risk management models risk identification, risk classification, risk analysis, risk response and risk monitoring form the core of project risk management. Therefore, a model consisting of these five stages is used in this study.

2.11 Risk Identification

Risk management always starts with risk identification, which may be considered the most important phase of the risk management process (Baker, Ponniah and Smith, 1998). It is aimed at determining potential risks, i.e. those that may affect the project. At this stage is to evaluate co-occurrence of specific risks and their relationships, so that the entire portfolio of risks can be managed, instead of a single one at a time. The most important thing is that risk identification creates the right database for any further steps related to the risk analysis

Risk identification, just like the entire risk management process, should be carried out continuously (i.e. throughout the entire lifecycle of an investment project) and in various dimensions, in various sections, from various perspectives and in various areas as this ensures that the most comprehensive list of potential risks a given investment project is exposed to can be compiled. It should also address both internal and external risks (Turnbaughs 2005).

PMI 2000 suggests that as many project stakeholders as possible should participate in the risk identification process. Risk identification is an iterative process that involves the project team, stakeholders and other managers affected by or who affect the project, and finally outside individuals who can comment on the completeness of the risk identification based on their similar experiences (Wysocki, 2004).

Risk identification greatly depends on the manager's experience. If his experience with particular methods and techniques of risk identification is good he will continue to use them,

whereas bad experience leads to avoiding approaches prepared earlier. A large number of techniques exist for risk identification, such as, brainstorming and workshops, checklist and prompt List, questionnaires and interviews, Delphi group or normal group techniques and various diagrammatic techniques like cause effect diagram, influence diagrams etc. (Hillson 2002).

In construction projects there are some standard risk areas that need to be considered and assessed, but each new project also brings specific project related risks, which need to be identified. The difficulty is the lack of accurate systems for identifying risks in a construction project. The studies that have been carried out over the past decade on the use of risk management practices in construction and other industries indicate that over this time: checklists, brainstorming and interview sessions have been the most commonly used risk identification tools; other techniques are rarely used due to lack of knowledge and doubts about their applicability in the construction industry; there is limited progress on the wider application of tools and techniques; there is concern that in practice the distinction between the risk management process phases is blurred and existing tools are not sufficient. Researches shows the construction industry relies heavily on historical data and the judgment of key actors involved in the project to identify risks. For instance, Chapman and Al-Tabtabai and Diekmann state that the identification of risks relies on the individual judgment and insight of the various actors involved in a project, which is dependent on their knowledge, professional training, role, level of responsibility and length of exposure to the construction industry. The premise of both research and practice in project risk management is that experience is the key to risk identification.

It is commonly acknowledged that of all the stages of risk management process, risk identification stage has the largest impact on the accuracy of any risk assessment (Chapman, 1998). To facilitate risk identification, risks can also be broadly categorized as controllable and uncontrollable risks (Flanagan and Norman, 1993). Further, controllable risks are those risks which a decision maker undertakes voluntarily and whose outcome is, in part, within our direct control; and uncontrollable risks as those risks which we cannot influence (Chege & Rwelamila, 2000).

During the risk identification process the potential risks fall in the different groups. There are several approaches to classifying project risks and risk sources (Baloi and Price 2003, Jaafari 2001, Leung et al. 1998, Li et al. 2005, Mbachu and Vinasitham by 2005, Tah and

Carr 2000, Zhi 1995). In general, the sources of risk in construction projects may be divided into three groups:

- Internal or controllable risks (e.g. design, construction, management and relationships);
- External or uncontrollable risks (e.g. financial, economic, political, legal and environmental);
- Force majeure risks.

Several studies contributed to knowledge by identifying unique, specific and country-related risks (Andi 2006, Ling and Hoi 2006, Zou et al. 2007). However, risk identification remains a poorly understood process and its tools and techniques are less developed compared to those used in the risk analysis phase.

2.11.1 Identification of Risk Factors in Construction Projects

Table 1. Summaries of identified risk factors as suggested by different researchers

Researcher(s)/ Work	Identified Critical Risks
Mustafa et al, (1991)	Inflation, Country economic condition and rules and regulations, unavailability of funds, financial failure
Prasanta Kumar dey, (2002)	Scope and design change, technology, weather and climatic condition, statutory clearance and approvals.
Ghosh et al, (2004)	Scope and design changes, inflation, country economic condition and rules and regulation, unavailability of funds, financial failure and construction delays
Laryea, (2007)	Scope and design changes, technology implementation, site conditions and unknown geological condition, inflation, country economic condition and rules and regulation, unavailability of funds, financial failure, lack of availability of resources
Enhassi and Mosa, (2008)	Scope and design changes, technology implementation, site conditions and unknown geological condition, inflation, country economic condition and rules and regulation, unavailability of funds, financial failure, weather and climatic conditions, poor safety procedures and construction delays
Sun and Meng, (2009)	Site conditions and unknown geological condition, inflation, country economic condition and rules and regulation,

	unavailability of funds, financial failure, inadequate management skills, improper coordination between teams, lack of availability of resources
Wang et al, (2010)	Inflation, country economic condition, statutory clearance and approvals, construction delays
Eybpoosh, (2011)	Scope and design changes, technology implementation, site conditions and unknown geological condition, inflation, country economic condition and rules and regulation, lack of availability of resources
Rezakhani, (2012)	Scope and design changes, technology, unavailability of funds, financial, weather and climatic conditions, poor safety procedures
Goh et al, (2013)	Scope and design changes, technology implementation, site conditions and unknown geological condition, inadequate managerial skills, improper coordination between teams lack of availability of resources, construction delays

Source: Renuka et al., (2014)

2.11.2 Risk Classification

PMBOK (Version 2008) defines risk classification as a provider of a structure that ensures a comprehensive process of systematically identifying risks to a consistent level of detail and contributes to the effectiveness and quality of the risks process identification. After having identified as many risks as possible, it is necessary to classify and categories risks so that more efficient analysis and management can be achieved. Risks can be classified based on their types, consequence, and source (Flanagan and Norman, 1993).

Risk classification is also an important step in the risk assessment process, as it `attempts to structure the diverse risks that may affect a project. There are many approaches in literature for construction risk classification. Perry & Hayes (1985) give an extensive list of factors assembled from several sources, and classified in terms of risks retainable by contractors, consultants and clients. Abdou (1996) classified construction risks into three groups, i.e. construction finance, construction time and construction design. Shen (1997) identified eight major risks accounting for project delay and ranked them based on a questionnaire survey with industry practitioners. Tah & Carr (2000) classified project risks by using the

hierarchical risk breakdown structure (HRBS) and classified them into internal and external risks. Chapman (2001) grouped risks into four subsets: environment, industry, client and project. Shen (2001) categorized them into six groups in accordance with the nature of the risks, i.e. financial, legal, management, market, policy and political. Assaf& Al-Hejji (2006) mentioned the risk factors as the delay factors in construction projects. Dikmen et al. (2007) used influence diagrams to define the factors which have influence on project risks. Zeng et al. (2007) classified risk factors as human, site, material and equipment factors. Risks can also be classified based on the project phases; pre contract stage and post contract stage (Thompson, 1992; Akintoye and Macleod, 1997). Perry and Heys (1985) classified risks as design and tender related risks, construction related risks, legal and contract related risks, financial risk, political and logistic related risk, physical, natural, operational and environmental related risks. On this research work Perry and Heys classification will be used.

I. Design and tender related risks

- Defective design
- Drawings and documents are not issued on time
- Poor definition of scope of work
- Change of design required by owners
- Owners' unreasonably imposed tight schedule
- Poor cost estimate
- Budget based on incomplete data;
- Unfairness in tendering

II Construction related risks

- Poor Quality of work
- Accident in construction
- Failure to identify defects
- Inadequate management and planning
- Feasibility of construction method
- Poor coordination
- Incompetence of contractor
- Lack of consultant experience
- Unpredicted technical problems in construction

- Unforeseen site conditions
- Material quality
- Low productivity of labour
- Low productivity of equipment
- Shortage of skills/techniques
- In appropriate organizational interface (government body interference)
- Unavailability of infrastructure
- Unavailability of Water and Electricity

III Legal and contract related risks

- Claims and disputes
- Delays in resolving contractual issues and disputes
- Stakeholders disputes
- Customs and duty problems

IV. Financial related risks

- Availability of funds
- Owners' delayed payment to contractors
- Inflation
- Exchange rate fluctuation
- Shortage in foreign currency

V. Political and Logistic related risks

- War threats and political instability
- Corruption and bribes
- Changes in laws and regulations
- Shortage in material supply
- Shortage in manpower and in equipment supply
- loss or damage in transportation

VII. Physical, Natural, Operational and Environmental related risks

- Unexpected inclement weather
- Earth quack, landslide and flood

- Loss or damage by fire

2.11.3 Risk Analysis

Risk analysis is involves quantifying the impact and the probability of occurrence of risks. After identification and classification of the probable risks, their impacts on the project objectives need to be assessed to develop proper response.

A defined and accurate estimation of risk events is the aim behind such analysis and to some extent makes the decision making of the process to be specific and definite (Estate Management Manual, 2002). Risk analysis can be described as short listing risks with the highest impact on the project, out of all threats mentioned in the identification phase (Cooper et al. 2005).

Risk analysis also indicates what could happen in the event that the project does not travel along the planned route (Flanagan & Norman, 1993).

In the analysis of the identified risk, two categories of methods – qualitative and quantitative – have been developed. The qualitative methods are most applicable when risks can be placed somewhere on a descriptive scale from high to low level. The quantitative methods are used to determine the probability and impact of the risks identified based on numeric estimations (Winch, 2002). Companies tend to use a qualitative approach since it is more convenient to describe the risks than to quantify them (Lichtenstein, 1996).

Brief discussion about the two basic types of risk analysis is presented as follows;

2.11.3.1 Qualitative Risk Analysis

Qualitative methods for risk assessment are based on descriptive scales, and are used for describing the likelihood and impact of a risk. It is considered as an evaluation process which involves description of each risk and its impacts or the subjective labelling of risk (high/medium/low) in terms of both risk impact and probability of its occurrence.

These relatively simple techniques apply when quick assessment is required (Cooper et al. 2005) in small and medium size projects (Heldman, 2005). Moreover, this method is often used in case of inadequate, limited or unavailable numerical data as well as limited resources of time and money (Radu, 2009). The main aim is to prioritize potential threats in order to identify those of greatest impact on the project (Cooper et al. 2005), and by focusing on those threats, improve the project's overall performance (PMI, 2004). The complexity of scales

(Cooper et al. 2005) and definitions (PMI, 2004) used in this examination reflect the project's size and its objectives. During the phases of the project life cycle, risks may change, and thus continuous risk assessment helps to establish actual risk status (Cooper et al. 2005). Limitations of qualitative methods lie in the accuracy of the data needed to provide credible analysis. In order for the risk analysis to be of use for the project team, the accuracy, quality, reliability, and integrity of the information as well as understanding the risk is essential.

Qualitative risk assessment involves assessment of risks using risk matrix to determine their likelihood and potential effect on the project objectives. After analyzing the risk matrix, risks can be classified as those will require detail consideration and those do not need to go beyond the stage by qualitative analysis.

Risk matrix analysis based on their impact and probability is shown in the following Figure No. 2.

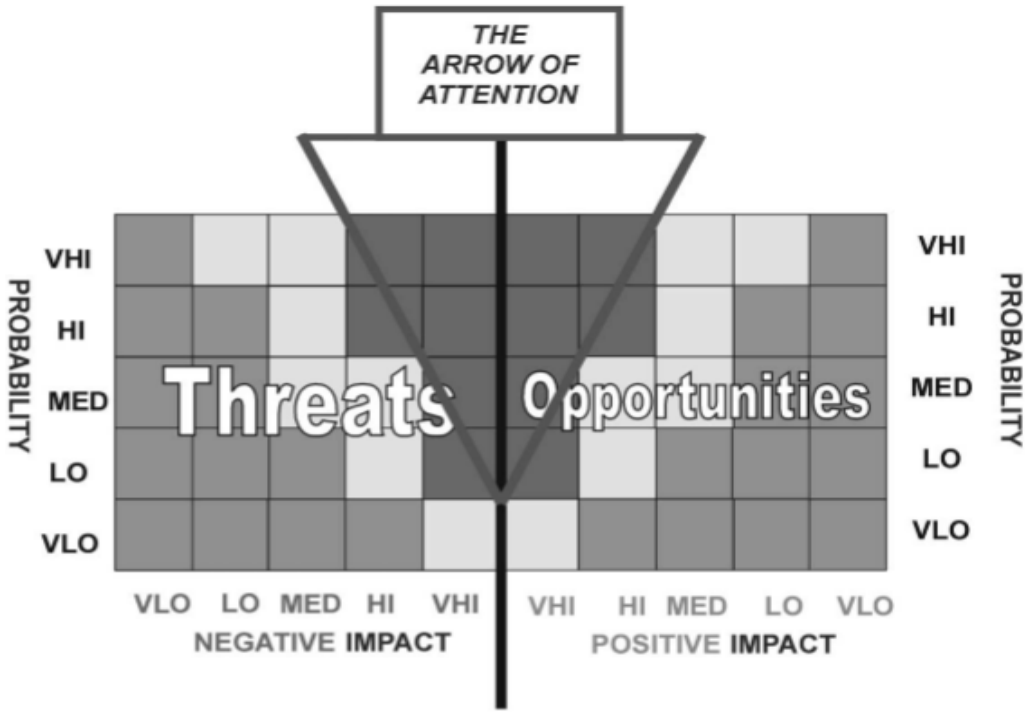

Figure 2. Risk Matrix for the probability and Impact, Source: Hillson (2002)

Whereby the above notations represent the following:

- VHI- Very High
- HI-High
- MED- Medium

- LO- Low
- VLO- Very Low

2.11.3.2 Quantitative Risk Analysis

Quantitative risk analysis is the most sophisticated technique and involves determination of the level of impact and probability of occurrence of projects risks (Thompson and Perry, 1992). The quantitative analysis is required for risks that have significant effect. The quantitative analysis usually uses the project program and cost estimates to quantify the effect of risks on time and cost constraints of the project.

There are number of quantitative risk analysis techniques used to analyze the impact and probability of occurrence of risk which includes; sensitivity analysis, probability analysis, Monte Carlo Simulation, Decision Tree Analysis and etc (Flanagan and Norman, 1993).

The output of the quantitative analysis includes the probability of achieving the project objectives including, cost, time and quality. The result can be used by contractors and employers in estimating the contingency amount that may be required to respond for the probable risks to achieve the project objectives. The analysis of the project risk must include the overall impact of the risks on the whole life of the project and this can be achieved by computing the net present value (NPV) of each possible combination of risk impacts using computer based analysis such as Monte Carlo simulation. The application of the quantitative risk analysis allows the construction project exposure to be modeled and quantifies the probability of occurrence of the identified risk factors as well as their potential impact.

The result of the analysis also can be used in developing appropriate risk management strategy which helps to minimize the negative effect of risk on project objectives. If the risk is found to be insignificant, no response could be required, whereas, particular attention should be taken for risks that could have significant effect on project objectives. In this process the majority of the significant risks managed and the result will be recorded in the risk register for successive analysis.

However, “risk analysis techniques are not widely used in the construction industry with the exception of decision makers’ intuitive and subjective judgment” (Akintoye and Macleod, 1997). Many literatures identified that the construction industry largely use check list from previous projects and there is tendency to use more qualitative analysis than quantitative methods. There are number of the reasons for not using risk analysis techniques in the

construction industry including: lack of familiarity with the technologies, the degree of sophistication involved in the techniques, and lack of time, information and knowledge.

Within the quantitative and qualitative categories, a number of methods which use different assumptions can be found, and it may be problematic to choose an appropriate risk analysis model for a specific project. The methods should be chosen depending on the type of risk, project scope as well as on the specific method's requirements and criteria. Regardless of the method chosen, the desired outcome of such assessment should be reliable (Lichtenstein, 1996). Perry (1986) mentions that the selection of the right technique often depends on past experience and expertise on the techniques, nowadays it also depends on the available computer software. Lichtenstein (1996) explains a number of factors that can influence the selection of the most appropriate methods in the risk assessment for the right purpose. It is up to each organization to decide which of these factors are the most critical for them and develop the assessment accordingly.

The ultimate deliverables of risk analysis process are probability of occurrence and impact level of risks. For the impact of risk, possible consequences of risk are defined and quantified in terms of (Smith 1999):

- Increased cost: i.e. additional cost above the estimate of the final cost of the project;
- Increased time: i.e. additional time beyond the completion date of the project through delays in construction;
- Reduced quality and performance: i.e. the extent to which the project would fail to meet the user performance based on quality, standards and specification.

2.11.4 Risk Response

This fourth step of the risk management process indicates what action should be taken towards the identified risks and threats. The risk response process is directed at identifying a way of dealing with the identified and assessed project risks. The response strategy and approach chosen depend on the kind of risks concerned (Winch, 2002). Other requirements are that the risk needs to have a supervisor to monitor the development of the response, which will be agreed by the actors involved in this risk management process. (PMI, 2004). Most common strategies for risk response are: avoidance, reduction (mitigation), transfer and retention (Potts, 2008). Beyond those types of responses, Winch (2002) describes that sometimes it is difficult to take a decision based on too little information. This may be

avoided by waiting until the appropriate information is available in order to deal with the risk. This way of acting is called delay the decision but this approach is not appropriate in all situations, especially when handling critical risks. Those need to be managed earlier in the process**.**

Once the risks of the project have been identified and analyzed appropriate risk response strategy must be adopted in order to take the necessary steps to minimize the negative effects of risk on project objectives. There are four strategies typically used for addressing risks including; risk retention, risk avoidance, risk transfer and risk mitigation (IEC 2001, PMI 2000, Smith et al. 2006).

According to Guo (2004) strategies for negative risks are as follows.

Risk avoidance: involves changing the project plan to eliminate the risk or to protect the project objectives (time, cost, scope, quality) from its impact. The team might achieve this by changing scope, adding time, or adding resources (thus relaxing the so-called "triple constraint"). These changes may require a Programming Change Request (PCR). Some negative risks (threats) that arise early in the project can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise. When an organization or parties or individual refuse to accept risk, then risk is avoided. This means the exposure of risk is not allowed to exist. If risk avoidance is used extensively, the opportunity to receive profit or achieve objectives may be decreased. There are a number of ways through which risks can be avoided, for examples, tendering a very high bid, placing conditions on the bid, and not bidding on the high-risk portion of the contract (Baker, Ponniah, and Smith 1999).

Risk transfer: Risk transfer requires shifting the negative impact of a threat, along with ownership of the response, to a third party. An example would be the team transfers the financial impact of risk by contracting out some aspect of the work. Risk transfer reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so. Risk transfer nearly always involves payment of a risk premium to the party taking on the risk. Transfer tools can be quite diverse and include, but are not limited to the use of: insurance, performance bonds, warranties, guarantees, incentive/disincentive clauses, etc.

Risk transfer can take two basic forms (Thompson and Perry 1992):

- The property or activity responsible for the risk may be transferred, i.e. hire a subcontractor to work on a hazardous process; or
- The property or activity may be retained, but the financial risk transferred, i.e. methods such as insurance.

Risk Mitigation: Risk mitigation implies a reduction in the probability and/or impact of an adverse risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk is often more effective than trying to repair the damage after the risk has occurred. Risk mitigation may take resources or time and hence may represent a trade-off of one objective for another. However, it may still be preferable to going forward with an unmitigated risk. Monitoring the deliverables closely, increasing the number of parallel activities in the schedule, early involvement of regulatory agencies in the project, early and continuous outreach to community's/advocacy groups, implementing value engineering, adopting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions (Caltrans 2007).

Risk Retention: It involves activities used to absorb the effect of risk. Risks that have no significant effect and are repetitive can be effectively managed through retaining the responsibility by the owner of the project. If the opportunity for risk reduction or avoidance is limited, the opportunity remain is risk transfer and retain (Potts, 2008). Retention can also be an option when other solutions are uneconomical (Thomas, 2009). Risk retention or acceptance indicates that the risk remains present in the project. Two options are available when retaining the risk: either to develop a contingency plan in case a risk occurs, or to make no actions until the risk is triggered several studies (Baker et al. 1999, Lyons and Skitmore 2004, Tang et al. 2007) have identified risk reduction as the most frequently used technique within the construction industry. The results of a questionnaire survey (Akintoye and MacLeod 1997) report that risk transfer is the most preferable strategy among the UK practitioners.

2.11.5 Risk Monitoring

This final step of risk management process is vital since all information about the identified risks is collected and monitored (Winch, 2002). The continuous supervision over the risk management process helps to discover new risks, keep track of identified risks and eliminate past risks from the risk assessment and project (PMI, 2004). PMI (2004) also states that the

assumptions for monitoring and controlling are to supervise the status of the risks and take corrective actions if needed.

Tools and techniques used to risk monitor and control may be (PMI, 2004):

- Risk reassessment – identification of new potential risks. This is a constantly repeated process throughout the whole project.
- Monitoring of the overall project status – are there any changes in the project that can effect and cause new possible risks?
- Status meetings – discussions with risk's owner, share experience and helping managing the risks.
- Risk register updates

By managing the whole risk management process, the process can be evaluated. This is a method of creating a risk register where all risks and their management can be allocated in order to facilitate future projects (PMI, 2004). This is also a way to improve the project work, since the advantages and disadvantages will be brought up.

Risk monitoring is the final stage of risk management cycle. The major role of risk monitoring is to ensure the effectiveness of the risk management system including identification; analysis and response are applied to the project (IRM, 2002). Risk monitoring system is required to maximize the effectiveness of risk response towards meeting the project objectives. Risk monitoring process also used to indicate the need for revision of cost and program in relation to the response for risk. Another important aspect of risk monitoring is to ensure that actual events are recorded for use in future projects.

Risk register is a record system in which the information including the identified risks and the proposed strategy as well as its result will be recorded for use of subsequent risk management activities.

2.12 Approaches to Risk Management

According to Smith, Merna and Jobling (1999), there are two basic approaches to risk management in projects:

- An informal approach
- A formal approach

The type of approach adopted influences the procedures and processes that will be used to manage risk in construction projects.

2.12.1 Formal Approach

The formal approach consists of a set of procedures established by an organization for use in the risk management process. These procedures are structured and give guidelines to be followed, so that they can be used by any member of the organization. This structure ensures the uniformity of the approach to various problems. This formalization of the risk management procedures ensures that the process is more objective than the informal approach. Most authors recognize objectivity as an essential feature of risk management. Formalized procedures for risk management in projects are designed to suit the needs of the particular organization; thus, there is no single methodology. However, there are frameworks for formalized risk management. Procedures do not detail the methods that should be used but allow the user to choose appropriate techniques. The quality of a formal process of risk management generally depends on management awareness, motivation of project personnel, a methodical approach, the information available (often linked to the project phase), the assumptions and limitations upon which the risk analysis is based, the qualifications and knowledge within the project, and the experience and personality of the risk analyst leading the process. Similarly, there are many well-known assessment pitfalls, including management bias, which occurs when an uncertain variable is viewed as a goal rather than as an uncertainty, and expert bias, which occurs when experts are expected to be certain instead of allowing them some uncertainty. This bias may lead to an underestimation of uncertainty.

2.12.2 Informal Approach

One of the most widely used techniques in the informal approach to risk management is the provision of contingency funds. There are two main types of contingency funds: lump sum contingencies and percentage contingencies. A lump sum contingency is a sum of money put aside in the project budget that is to be used if extra money is required during the project. A percentage contingency is similar to a lump sum contingency; however, instead of being fixed sum money, it is a percentage of the total project cost according to the project budget. Contingency funds can be used as a risk management technique because the amount of money allocated to a contingency fund should be representative of the cost of the risks thought likely to occur in a particular project. A contingency fund is not financially

representative of all the possible risks in a project because it is unlikely that all the possible risks would be realized. Thus, while a contingency fund is available, it is not to be spent unless it is needed. Other informal procedures for the management of risk involve talking to experts or people with experience in similar projects and gaining their views as to the possible risks in a project and then reviewing the project given the identified possible risks. The situation and environment are subject to change and may grow more demanding; thus, all participants become more conscious of the risks they are carrying. Therefore, implementing risk management is approached with either formal or informal methods to ensure the project objectives are achieved. Finally, identifying risks is not a science: it is an art. It does not require a sophisticated, mathematical exercise, although some measurement may be useful to dimension the risk. Given a project description including project goals, work breakdown, schedule, and resource assignments, potential risks can be identified and categorized using various tools such as brainstorming, peer review, and document review (Barkley, 2004). Risk is always present and must be dealt with accordingly. Risk management can be sophisticated and complicated, but the starting point should always be a simple assessment of the problem and possible solutions. The risk management process can be defined as a logically consistent framework used to develop the process of finding and understanding alternative risks, assessing their risk and uncertainties, identifying the resources needed and choosing appropriate courses of action to address these risk factors and achieve the desired results. The construction industry is subject to more risk and uncertainty than many other industries. Therefore, the need for risk management is higher. The managerial techniques used to identify, analyses and respond to risk have been applied in the industry using either an informal approach or formal approach.

2.13 Risk and Tendering in Construction

Construction industry in most countries is an extremely competitive industry typified with high risks and low profit margins when compared with other sectors of the economy (Mochtar & Arditi, 2001). Tendering is the popular means by which a company secures work and the price they put forward in the tender is the only instrument for earning revenue. This sets the backdrop as to why it is so important to consider risks in construction contracts as the optimum mark-up needs to be achieved to increase chances of being successful.

Since the lowest price is generally the one accepted in the competitive tender process, especially for government contracts (Nutakor, 2007), the onus is then on the prospective

contractor to deliver as low a bid as possible. This consequently shapes the treatment of risk and attitude to how they price it. With the above in mind when tendering it is critical to identify the optimum mark-up for the project as this increases the contractor's chances of being successful and winning the tender (Ling & Liu, 2005).

2.14 Risk Allocation through Contract

It is impossible to eliminate all potential risks in a construction project. Therefore, an appropriate allocation of risks among project actors is very important. Risk allocation influences the behaviour of project actors and, therefore, has a significant impact on the project performance in terms of the total cost. Unclear allocation of the project risks leads to disputes between the client and the contractor. One of the problems identified in the literature is the actors' different perceptions of to whom a specific risk or group of risks should be allocated. Usually, contractors indicate that they have to bear the majority of project risks and price these risks through adding a contingency to the bid price (Andi 2006).

Using contingency funds has been identified by the researchers and practitioners as a significant source of the project's cost increase (Zaghloul and Hartman 2003). Evaluation and conscious allocation of risks to the appropriate actor under the contract allows reducing the bid price by decreasing contingency funds and, therefore, leads to lower total cost (Zack 1996).

A number of models providing a framework for risk allocation decisions can be found in the literature (Lam et al. 2007, Li et al. 2005, Olsen and Osmundsen 2005). Smith et al. (2006) highlight the importance of considering the following issues when making risk allocation decision:

- Who has the best ability to control risk events?
- Who has the best conditions to manage risks?
- Who should carry the risks that cannot be controlled?
- How much does it cost to transfer the risks?

Risk allocation strategy in construction projects is defined through the contractual arrangements. The contract is a written agreement between a client and a contractor where the liabilities and responsibilities of each party are assigned. The contract can also be defined as a trade-off between the contractor's price for executing the project and his willingness to

take the risks (Flanagan and Norman 1993). There are different contract strategies available. The objective of clients is to choose the strategy that ensures achievement of the project objectives in the most efficient way.

The general conditions of contract, 2006, prepared by the Public Procurement Agency (PPA) of Ethiopia also have different clauses that deal with the general risks common to most projects.

Clause 20: states that "the consultant should have an insurance coverage against risks specified in the special conditions of contract". This implies that the risks which are believed to have an effect on the execution of the project should be clearly identified and dealt with in the specific conditions of the contract by providing enough insurance coverage. The article further discusses that a consultant needs to have professional indemnity insurance before award of any contract. This is one way of dealing with risk by making sure the consultant is covered for any fault that might occur during the design and supervision of the project.

The general conditions of contract by the ministry of works and urban development (MoWUD), identifies some special risks which the contractor is not liable for. Some of these special risks are war hostilities, invasion, act of foreign enemies; contamination by radio-active components, pressure wave caused by aircraft or other aerial devices; riot, commotion, or disorder, unless solely restricted to employees of the contractor or his sub-contractor and arising from the conduct of the works; rebellions, revolution, military or usurped power, or civil war. This general condition of contract further states in the following statement that the contractor should be provided with payment to rectify any damage or destruction caused by the special risk and to replace any material or property needed to complete the project.

If the works or any materials on the site or any property of the contractor used or intended to be used for the purpose of the works, sustain destruction or damage by reason of any of the said special risks, the contractor shall be entitled to payments in accordance with the contract for any permanent work duly executed and for materials so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the works.

Table 2. Risk allocation in condominium projects by contract

Identified Risks	**Allocation of risks based on contract document (Main Party Responsible for the Risk)**	**Contract Part**
Defective design	Owner	Scope of Works
Drawings and documents are not issued on time	Owner	Scope of Works
Poor definition of scope of work	Owner	Scope of Works
Owners' unreasonably imposed tight schedule	Contractor	The Engineer has the power to crash the schedule
Poor Quality of work	Contractor	GCC 34
Accident in construction	Contractor	GCC 40
Failure to identify defects	Contractor/ Consultant	GCC 34
Inadequate management and planning	Contractor	GCC 34
Feasibility of construction method	Contractor	GCC 34
Poor coordination	Contractor	GCC 34
Foreseen technical problems in construction	Contractor	GCC 34
Unforeseen conditions	Owner	GCC 73.1 (g)
Material quality	Owner	Schedule requirement
Low productivity of labour	Contractor	GCC 34
Low productivity of equipment	Contractor	GCC 34
High quantity variation	Owner	If it is greater than 25% GCC 15.7
Conflicts in documents	Owner	Since the documents are prepared by the owner or his representative
Stakeholders disputes	Owner	Since it is out of the scope of the contractor
Customs and duty problems	Owner	Imported items are provided by the owner As per the Schedule of requirement
Availability of funds	Owner	Payment should be paid on time GCC 59

Inflation	Owner	Unforeseen condition GCC 73.1 (g)
Exchange rate fluctuation	Owner	Materials are imported by the owner as per the schedule of requirement
Shortage in foreign currency	Owner	Unforeseen condition GCC 73.1 (g)
War threats and political instability	Owner	Unforeseen condition GCC 73.1 (g)
Changes in laws and regulations	Owner	Unforeseen condition GCC 73.1
Shortage in material supply	Both owner and contractor	Since nails, formwork and sand are provided by the contractor for this materials the contractor is responsible but for other materials it is the owner responsibility to provide them at the time of required (mentioned in schedule of requirements)
loss or damage in transportation	Both owner and contractor	Schedule of requirements
Unexpected inclement weather	Owner	Unforeseen condition GCC 73.1 (g)
Earth quack, landslide, flood and fire	Owner	Unforeseen condition GCC 73.1 (g)

As mentioned above, the standard contract documents used in Addis Ababa condominium industries deal with some risks which are common in all building construction projects. And most cases the same or similar type of contract is adapted for all kind of condominium projects but it risks are unique and specific to any particular project be identified and included in the particular conditions of the contract so that they can easily be managed if and when they occur.

The Insurance industry plays a predominant role in managing construction risks through different arrangements. Babu, and Kanchana (2014: 209) discussed the following arrangements;

- **Contractor's All Risk Policy (CAR):** This policy is specially designed to give financial protection to the Civil Engineering Contractors in the event of an accident to the civil engineering works under construction.
- **Professional Indemnity Policy:** This policy is meant for professionals to cover liability falling on them as a result of errors and omissions committed by them whilst rendering professional service. The policy offers a benefit of Retroactive period on continuous renewal of policy whereby claims reported in subsequent renewal but pertaining to earlier period after first inception of the policy, also become payable.
- **Contractor Plant and Machinery Policy**: The sum insured of each item of machinery should represent the current purchase cost of a similar new machine including all incidental expenses like freight, duty, taxes, cost of erection etc.
- **Public and Product Liability**: It is also known as combined liability or general liability. Public liability is a legal ability to pay compensation to third parties arising in connection with the business activities of the insured. Product liability is the legal ability to pay compensation to third parties arising in connection with the insured's products.
- **Worker's Compensation policy:** This insurance effectively covers all liabilities whether arising under statute or at common law, in relation to death or injury of employees or persons demand to be employees.
- **Compulsory third-party motor vehicle insurance policy:** Principals often require the inclusion as required by the statute in the relevant jurisdiction for vehicles used in connection with work under the contractor.

2.14 Cost of Managing Risks

As we seek to manage risk effectively, questions of cost also arise since risk management is not free. There is no "zero-cost option" for risk management, and the costs to be paid fall into three categories: one-off, ongoing, and occasional. First are the costs of entry, paid once to establish a risk management capability. The primary cost here is for the "Three T's": techniques, tools and training. Any organization wishing to manage risk has to invest in the necessary infrastructure to support the risk process. Techniques and procedures must be developed and rolled out. Tools to support the process must be bought or developed. And staff must be trained to use the techniques and tools effectively. If the entry cost is not paid, risk management remains merely a good intention, with no capability to deliver. The second

types of costs are for ongoing maintenance, to preserve an effective organizational risk management capability. It is important to keep the risk process fresh and up to date. Without ongoing development of the risk process, there is a danger of losing effectiveness. Risk management is a developing discipline, and new techniques and tools emerge regularly. Even the conceptual basis continues to grow as new ideas become accepted into the mainstream. Effective risk management requires refresher training to maintain and develop staff skills, as well as revitalizing the process to incorporate recent developments and new approaches. On average an organization should aim to refresh its risk process every 2-3 years to stay up to date. Lastly there are the costs associated with managing risk on projects. Each project faces a unique risk challenge, and managing this incurs costs for assessing risk and for addressing risk.

- Assessing risk: These are the costs of implementing the risk process on the project, including spending time and resources in risk identification workshops or interviews, performing risk assessments and analyses, attending risk reviews, writing risk reports etc.
- Addressing risk: This covers the cost of executing risk response plans, those actions which were not originally in the project plan, but which are deemed necessary in order to deal appropriately with identified risks. Proactive actions are needed to avoid or reduce threats, and to exploit or enhance opportunities. Contingency and fallback plans must be put in place in case risks occur. These costs would not have been incurred if risks had not been identified, but they are necessary to optimize the chances of achieving project objectives.

If an organization is serious about managing its risk, it must be prepared to pay these costs. This is particularly true of projects, which tend to have fixed budgets. Risk management will never be effective if it is seen as an optional zero-cost extra. The cost of assessing risk must be included in the overall project management budget, and there must be adequate contingency in the project budget to cover the costs of addressing risks. Of course there is a cost-benefit relationship from investing in risk management. Risk management delivers a wide range of benefits to the organization and to its projects, clients and staff. Although it is hard to measure the return on investment for risk management, it is certain that no benefits will be realized unless the organization is prepared to pay these costs. Indeed, not paying the cost to implement risk management exposes an organization to another unnecessary cost –

unmanaged risk. This includes threats which turn into problems which could have been avoided, as well as missed opportunities which could have delivered extra benefits.

2.15 Assessment of Risk Management System Culture within a Construction Industry

An organization's risk culture describes the degree to which its culture encourages or limits the taking of risks and the opportunities that arise from those risks.

2.15.1 Risk culture

An organization's risk culture describes the degree to which its culture encourages or limits the taking of risks and the opportunities that arise from those risks. This risk culture can vary from everyone in the organization operating intuitively and blindly unaware of risks, all the way through to culture where attitudes and behaviours demonstrate careful consideration of risks and opportunities in advance of their potential occurrence.

A mature risk culture in a Board is that risk will be part and parcel of each and every conversation and decision. When the Board is considering strategy, it will look at the risk appetite necessary to deliver the strategy and how and what risks will drive the business forward. When the Board observes and interacts with the CEO and senior management, directors are considering how the risk appetites of these individuals align to the risk appetite of the Board.

In a mature risk culture, processes and Board mindset drive the management of immediate risk, the understanding of new and emerging risks, and an ongoing exploration that increases the resilience and adaptive capacity of the organization to future (unknown) risks.

The survival of most companies largely depends on their vision regarding the challenges they must face in the competitive environment of their area. Risk management theory can be of aid in providing a solid base from which to identify the risks that companies will have to confront while competing. By managing their risks, companies can not only survive but also attain greater competitiveness and stability in the business.

Risk Management, at the company level, is mainly based on the analysis of a business's strengths and weaknesses in an environment of great uncertainty. According to Courson (2008), one of the most critical problems faced by many companies is not knowing what risks they are confronting, far less finding a solution. Verbano & Venturini (2013

The construction industry, in particular, is highly prone to risk and, on a global scale, it is considered one of the most dangerous (Oladipo 2014). The complex and dynamic setting of construction projects creates an environment of high uncertainty and risk; the industry is vulnerable to distinct types of risks: technical, socio-political and commercial (Ehsan et al. 2009). Given this high degree of danger, it is indispensable to identify the way in which risks can be reduced; however, Tang et al. (2007) observed that the application of effective risk management in the construction industry appears to be very informal. This practice could be due to: insufficient knowledge of risk management, inefficient risk control strategies and inappropriate distribution of risks (Mohd Abdullah N.A. et al. 2012).

Given the above, the need to give an impulse to the culture of Effective Risk Management in the construction industry must be addressed; to achieve this, trained personnel are required to assess and manage the risks these companies must face. This industry must have guidelines which can help identify the risks, assess their magnitude and impact, and make decisions regarding their management. It can be said that an effective system of risk assessment and management for the construction industry remains a challenging task for the industry practitioners (Ehsan et al. 2009).

Moreover, in a study which describes the process for the development of an evaluation model and an instrument for risk management, Serpell et al. (2015) mentioned that, in developing countries, the construction organizations have addressed risk management using a series of practices which are usually insufficient, producing poor results on most occasions and limiting the success of project management.

2.15.2 Perspective of Construction Professionals on Risks

There are many parties involved in the construction industry such as clients, contractors, subcontractors and insurers. Each party has different perspective based on their respective viewpoint, attitudes, experience and benefits (Akintoye and Macloed, 1997; Baloi & Price, 2003). Risks that could result in cost overrun and delay in time are the concern of clients, contractors usually give more attention to project risks that would affect their profit; workers usually give more attention to project risks related health and safety and accidents; insurers may be concerned about insurable risks. Thus, it is not surprising to find different perception about risk among the parties participating in the construction industry.

Some contractors believe that risk management would involve considerable amount of extra cost to the project. However, from repeated research findings, it is noted that the total cost of risk management is insignificant as compared to the cost that would be incurred to mitigate the effect of risk in the absence of risk management (CIRIA, 2004 in Liu, 2005).

Individuals will have different risk attitude based on their belief, knowledge and experience (Wang and Yaun, 2001). This is the reason why different decision makers would make different decision even in the same situations. In some cases even opposite decisions can be made in the same situation by different decision makers with different attitude.

Risk attitude among the project participants has significant effect on the decision that will be made in managing risk. Thus, it is necessary to take into consideration the decision maker's risk attitude before assigning to manage risk (RAMP, 2005). Risk loving decision makers may take or retain more risks and more ready to use the opportunities. The converse will apply to risk adverse decision makers who are usually ready to transfer risk.

Risk perception among the project practitioners can be maximized as they allowed participating in risk management activities and when they are accountable for their work. Provision of the necessary training and brain storming the project practitioners and decision makers increases their perception about risk.

2.15.3 Organizational Activities towards Risk Management

The availability of good understanding of risk at all level of the organization will have crucial role in the efficiency of the risk management. The effectiveness of the risk management increases as risk awareness particularly among the decision makers increases and as there is integration between the risk management and culture of the organization.

There are number of activities that need to be taken in order to create risk management culture in the organization and to integrate it in to the regular management system which includes: provision of risk training and risk workshop, commitment from the decision makers, assignment of risk management responsibilities throughout the organization, risk management activities performance evaluation and reward, flattened the organization structure to enhance decision making process, etc.

The types of exposure to risk that an organization is faced with are wide-ranging and vary from one organization to another. These exposures could be the risk of business failure, the

risk of project financial losses, the occurrences of major construction accidents, default of business associates and dispute and organization risks. It is desirable to understand and identify the risks as early as possible, so that suitable strategy can be implemented to retain particular risks or to transfer them to minimize any likely negative aspect they may have.

2.15.4 Risk versus Projects Cost and Time Objectives

Risks affect projects to achieve its targets including time, cost, quality and performance. Hence, it is necessary to implement risk management for projects in order to minimize the effects of risks on project objectives. The application of effective risk management to the project facilitates the achievement of project objectives and at same time for the project success. This indicates that there is direct relationship between effective risk management and success of the project (Baloi and Price, 2003).

It is not surprising that many construction projects are suffering of extensive delays and cost overrun due to various reasons. The major cause of this problem is the absence of effective risk management in the project management. Thus, the implementation of effective risk management plays crucial role in the progress of the project. This implies that the company's experience in risk management activities plays crucial role for success of the project (Perera, 2009).

From previous literatures, it is noted that different risks have different impact contribution on the project objectives. Some of the individual risks may be more significant than the others. Thus, the success of the project depend on the effectively of the response strategy applied for combined effect of the significant risks and on the company's ability to manage risks (Dikmen, Birgonul, Han, 2007).

2.15.5 Risk versus Project Stages

The construction project consists of sequential stages in a project development cycle; conceptual, planning and design, procurement and construction, and commissioning.

The application of risk management is important for every project especially at the early stages (Zou, 2007). The application of risk management in the early phase of the project is more valuable, since the decisions taken at this stage tend to have a significant impact on the final project cost and time.

However, the construction industry has been rather slow to adopt risk management at early phases of the project (Flanagan and Norman, 1993; Uher and Toakley, 1999). This is mainly because lack of knowledge and expertise and lack of commitment to training and professional development on the top of other industry's related problems.

As much research suggested, addressing project risks earlier rather than later in the project life cycle can minimize the negative consequence brought by the risks (Ward and Chapman, 1995; Smith, 2003).

2.15.6 Benefits with Risk Management

To maximize the efficiency of risk management, the risk management process should be continuously developed during the entire project. In this way, risks will be discovered and managed throughout all the phases (Smith et al. 2006). The benefits from risk management are not only reserved for the project itself, but also for the actors involved. The main incentives are clear understanding and awareness of potential risks in the project. In other words, risk management contributes to a better view of possible consequences resulting from unmanaged risks and how to avoid them. (Thomas, 2009) Another benefit of working with risk management is increased level of control over the whole project and more efficient problem solving processes which can be supported on a more genuine basis. It results from an analysis of project conditions already in the beginning of the project. The risk management also provides a procedure which can reduce possible and sudden surprises (Cooper et al. 2005 and Perry, 1986). Different attitudes towards risk can be explained as cultural differences between organizations, where the approach depends on the company's policy and their internal procedures (Webb, 2003). Within the risk management, three company's approaches can be distinguished. The first one is the risk-natural firm which does not invest much in risk management but is still aware of the most important risks. The second approach is the risk-averse, where no investments are made in order to reduce the probability of occurrence of risk. The last one is the risk-seeker where the organization is prepared to face all risks and is often called gambler. In the long term, the risk-seeking companies can get a lower profitability compared to risk natural firms. This is because of the large investments and losses when repeating the risk management processes over and over again to ensure all risks have been managed before the risks actually occurs (Winch, 2002).

2.15.7 Limits of Risk Management

The level of risk is always related to the project complexity (Darnall and Preston, 2010). The fact that there are so many risks which can be identified in the construction industry can be explained by the projects size and their complexity. The bigger the project is, the larger the number of potential risks that may be faced. Several factors can stimulate risk occurrence. Those most often mentioned in the literature are financial, environmental (the project's surrounding, location and overall regulations), time, design and quality. Other influences on the occurrence of risk are the level of technology used and the organization's risks (Gould and Joyce, 2002). Cleden (2009) claims that complexity is a factor that can limit a project; the bigger and more complex a project is, the more resources are required to complete it. Moreover, when all potential risks have been identified, the project team must remember that there might be more threats. Therefore, the project team should not solely focus on management of those identified risks but also be alert for any new potential risks which might arise. Risk management should be used as a tool to discover the majority of risks and a project manager should be also prepared for managing uncertainties not included in a risk management plan (Cleden, 2009).

2.15.8 Project Risk Management in Construction Industry

Risks in construction projects are a significant element of the total project costs and thus their allocation has a major effect on project budget. Construction projects are open systems, rather than closed systems, which adds to the variability and riskiness of the project. The risk management process has to be adjusted to the cooperative environment in construction projects, but unfortunately this has not yet happened. Risk management in the construction industry still relies heavily on contracts, and the industry has the bad reputation of becoming involved in numerous disputes and claims. According to various studies, contractual structures are the main sources of the lack of flexibility and they have a significant negative effect on the actor relationships.

The first improvement effort in the construction industry is an attempt to promote the risk management process. Risk management should be implemented; contracting risks to other parties does not mean they are managed since nothing is done to deal with these risks, rather only the final cost of the contract is increased. Contract clauses are estimated to raise project costs by 8-20% of the total costs. This supports and motivates efforts to find alternative methods in managing risks.

Apart from contracts, studies show that construction risks are mainly handled with experience, assumption and human judgment. Since risks are highly situation-specific, expert judgment provides sufficient means of risk management. Problems occur when this expert knowledge isn't documented (which is common in the construction industry) and knowledge is not transferable. Other risks relate to possibly biased decision making, when personal background and assumptions inevitably reflect on the person's evaluation.

The usage of risk management techniques is varied in the construction industry. Brainstorming and team analysis for identifying risks are the most frequently used techniques, computer-aided methods are rarely used. Often risk management is restricted only to the identification phase, events can be known in advance, but their extent is not quantified. The biggest barriers in construction project risk management are a drive for cost effectiveness; risk management is seen only to consume resources and benefits are difficult to measure in financial terms. Lack of risk management resources and know-how restricts the use of risk management techniques. There are not enough capable personnel to conduct the risk management process and risk management is only in the heads of a few key people. Lack of an industry accepted model of risk analysis forces every construction company to form and test its own risk management models. Also cultural issues such as negative attitudes and mistrust of risk analysis, affects the results of the process. Simply a lack of knowledge and communication causes risk management failures.

Construction projects face a significant amount of uncertainty that is not related only to the early phases of the project. Odeh and Battaineh recommended the following improvements to construction risk management: incentives for early completion should be included in to the contracts and adopting a new approach to awarding experience instead of the lowest price. That way an experience would have the weight it seems to deserve. In a network viewpoint the financial allocation of risks is critical. Zaghloul and Hartman said an adequate risk sharing system should be the kind that would give the benefits of risks not occurring in all parties. Floricel and Miller suggested establishing shared financial safety reserves for mitigating crises when they happen.

2.15.9 Gap Identification

For the last four decades the risk management research has developed extensively in the construction industry (Forbes et al., 2008) assumed that construction projects are visible to

risk at the time of their coming into existence (Schieg, 2006) and are observed to have more essential risk due to the involvement of many contracting parties such as owners, contractors and designers, among others (El-Sayegh, 2008).

Research carried out by Ojo, (2010) on claims and contract disputes in a number of construction projects in Nigeria, had reflected the event of risks occurrence that were not well analyzed or integrated by either clients, contractors and consultants as one of the main causes of claims and disputes in the construction projects. According to a study carried out by Bowers and Khorakian (2014), in most constructions industries of developing countries of the world, very little facts on successful implementation of risk management systems is known.(Lyons and Skitmore, 2004) discovered that the most conventional risk identification methods utilized in the engineering construction industry is brainstorming. Among several others; probabilistic analysis, sensitivity analysis and decision trees are some of the risk analysis techniques used in Australia. Researchers in Qatar have been able to discover what the contractors and most of the owners suffer from, which is the absence of understanding of the methods of alleviation and risk prevention. Additionally, the manipulation of risk analysis approaches is absent and generally they rely on the subjective prudence utilizing past experience in time and cost estimation

According to Getachew Tesegaye 2009 and Addis Mesfin 2009 researches on risk management of road projects and building projects of Ethiopia indicated that road and building construction projects don't use risk management techniques in their projects because of lack of awareness about their significance and some don't use them fearing they need to hire additional staff and acquire more resources. Moreover, there is no study regarding risk management of Condominium projects in Ethiopia where much of project cost is financed by the governments, in hope of decreasing housing shortages. But existing condominium projects in Addis Ababa cannot be risk free and but needs evaluation to assess risk management practice to order to reduce the consequence of the risks. As a gap this research will study risk management practice of Addis Ababa 10/90 and 20/80 condominium projects, it will identify the risks causing cost overrun, time overrun and quality deviation of Addis Ababa 20/80 and 10/90 condominium projects at its lifecycle and it also assess risk management and risk allocation mechanisms.

The research approach is qualitative approach to tackle the problems related to risk in Addis Ababa condominium projects. Accordingly, the client, contractors and consultants who participated in design, supervision and construction works will be sampled and investigated by for the availability of construction risk management practices and impacts on the project performance respectively. Therefore, the focus of the study is to identify construction risk management practice, to assess cause and impact of construction risk and evaluation of risk allocation mechanisms from professional's perspective. The main contribution of this study is to enlighten how condominium construction projects are affected by improper risk management as well as to identify the key risks causing project's objectives un-attainment.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology of the research work. The main topics included in this chapter are research approach, research design and data collection. The objective of this paper is to study risk management practice in 10/90 and 20/80 condominium projects in Addis Ababa, to identify the risk factors that cause cost overrun, time overrun and quality deviations, to assesses risk allocation methods in the contracts of 10/90 and 20/80 condominium projects in Addis, Ababa and finally to make conclusion and recommendation based on the findings. The research strategy and design to be followed towards this end are discussed as follows.

3.2 Research Strategy

Two types of research strategies are used at studies, quantitative and qualitative research. Quantitative research approach focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon on 6but the qualitative approach seek to gain insights and to understand people's perception of "the world" whether as individuals or groups (Fellows and Liu, 1997). The research strategy adapted for this research is qualitative research. Qualitative research is chosen to know stakeholder’s perception regarding risk management.

3.3 Research Design

"Research design" refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Poilt and Hungler, 1985). This research consists of five phases; the first one is the proposal for identifying and defining the problems and establishment of the objectives of the study. The second phase of the research includes literature review. Literatures of risk management in building construction are reviewed. The third phase of the research included a methodology of the thesis. The fourth phase of the research includes result and discussion. In this phase the result of questionnaires and unstructured interview is discussed. The last phase of this research includes the conclusions and recommendations. As indicated in the figure 3, below, the research process illustrated in the process as flow chart

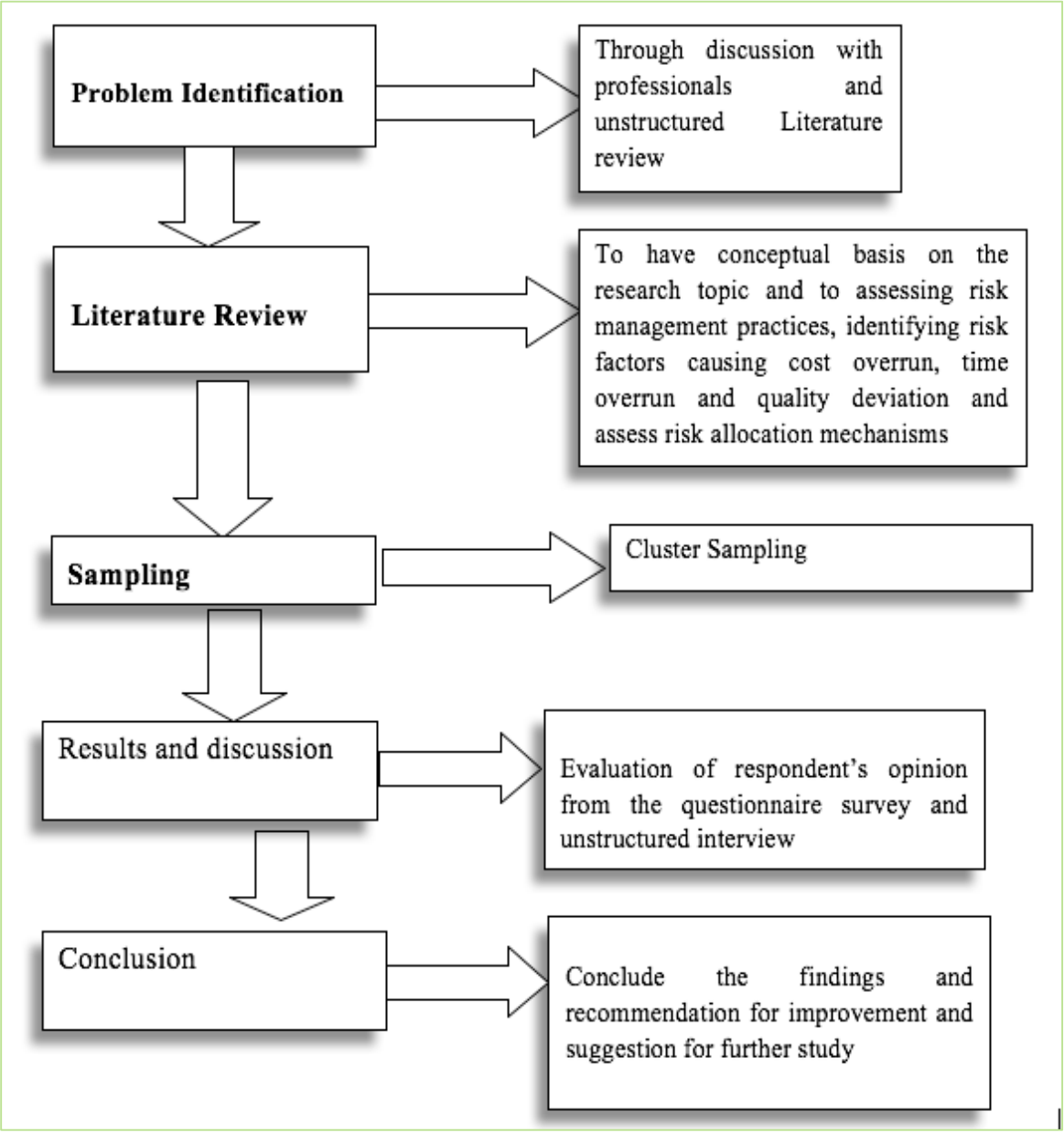

Figure 3. Representation for Research Methodology flow chart

3.4 Research Type

This research can be categorized as applied, exploratory, and descriptive. It is applied and exploratory because the research finds out whether risks are formally managed in Addis Ababa 10/90 and 20/80 projects or not and it also explore risk factors causing time and cost overrun and quality deviations. In addition, it is descriptive because it described the key risk factors causing time overrun, cost overrun and quality deviations in Addis Ababa 10/90 and 20/80 projects.

3.5 Scope and Limitation

There are many risk factors that causes time overrun, cost overrun and quality deviations in building construction projects. Each cause has different rate of occurrence and impact on the final time, cost and quality. Therefore, this paper will identify key causes of risks that because time overrun, cost overrun and quality deviations and their impact on 10/90 and 20/80 condominium projects that found in Addis Ababa.

The completed projects are addressed and the ongoing projects are tried to be assessed through unstructured interview and the research work is limited to client, contractor and consultants who have direct involvement in 10/90 and 20/80 condominium projects in Addis Ababa. The research did not address subcontractors, small and middle enterprises, suppliers, end users and other stakeholders due to vastness of the topic to be assessed within the scope of this research work.

3.5 Source of Data and Data Collection Methods

Clients, contractors and consultants who participated on 10/90 and 20/80 condominium projects found in Addis Ababa are main source of information. Furthermore, I also had informal discussion with professionals within the industry on subjects that were difficult to understand and where I had knowledge limitation as the subject matter.

The method of data collection is based on the purpose of the evaluation, how the respondent can be reached, how they might respond and on available resources such as time and budget. Thus, considering all of these factors, the data collection approach employed are questioner and unstructured interviews.

In order to design a questionnaire one needs to identify various factors extracted from a literature review. Hence a conceptual literature review was extensively made and various concepts that help in the study of risk management practice, to identify risk factors that contribute time overrun cost overrun and quality deviation and risk allocation mechanism are assessed. Following this 37 risk factors that result in cost and time overrun and quality deviation are identified. Culture assessment tools were also extracted to develop questions on current practices of risk management.

After having designed a questionnaire survey, in order to avoid biasness Simple two-stage cluster sampling method is taken: the process start from list all the clusters in the population

in this case sites, the sites that are completed and contain 10/90 and 20/80 condominium projects i.e. Bole Arabesa, Yeka Abado and Kuya Ficha. Completed sites are selected for the research work since it is easy to conclude there is time overrun, cost overrun and quality deviation problems. Then selecting the cluster usually by simple random sampling here Yeka Abado randomly selected. The units (elements) in the selected clusters of the first-stage are then sampled in the second-stage, usually by simple random sampling (or often by systematic sampling). In Yeka Abado 10/90 and 20/ 80 projects 117 contractors, 2 consultants and 1 government body (client) had been participated

3.6 Sample Size

Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population. Among the many types of sampling techniques, cluster sampling is used for the research.

The target extracted population is contractors, consultants and client who participated on Yeka Abado projects and in addition to that the contractor has to be more than Grade BC5 and GC 5 to be in the sample population this is because if they have high grade the probability of participating risk management system is high. Accordingly, 45 contractors had BC5 grade and more and 16 contractors had GC 5 grade and more during construction of Yeka Abado project. The consultants who are participated in the project are category one consultants and they are 2 in number.

The following formula has been used to determine the sample size of unlimited population (Ayoubsnd McCuen, 2000- creative reatch system, 2005).

$$SS = \frac{Z * p(1-p)}{c^2}$$

Where, SS= Sample Size

Z= Z value (e.g.1.28 for 80% confidence level)

P= percentage picking a choice (0.5 used for sample size needed)

C= confidence interval (0.05)

SS= 1.28^2 *0.5*(1-0.5)/0.05^2 = 164

Correction for finite population for contractors

$$New\ SS = \frac{\frac{SS}{1} + (SS - 1)}{Pop}$$

Where, SS = Sample Size

Pop = population

New SS =164/1+ (164-1)/61**=45 contractors**

For consultants, SS= 1.28^2 *0.5*(1-0.5)/0.052 = 164

New ss = ss/1+ (ss-1)/Pop

=164/1+ (164-1)/2**=2 consultants**

The data is also collected from the owner of the 10/90 and 20/80 condominium projects, Addis Ababa Housing Construction Project Office.

The table below shows the summary of grade and category of contractors and consultants participated in responding the questionnaire for analysis and discussion of the questions raised on the questionnaire is hereunder:

Table 3. Grade and category of Contractors and Consultants respond to the questionnaire

Grade and category of sampled Contractors and Consultants and Client	Number of Questionnaire distributed	Number of Respondents
Contractors:		
Grade BC 5	21	11
Grade GC 5	12	10
Grade BC 4	10	9
Grade BC 3	2	2
Consultants:		
Category 1	2	2
Owner:		
AAHCPO	2	2

3.7 Method of Analysis

The section which comprises chosen questions will be analyzed individually using charts and tables in addition answers on the risk factors that lead to cost overrun, time overrun and quality deviations are rated on likert's scale. Finally, conclusion and recommendation are given.

The following indices as given by Assaf and Hejji (2006) and other statistical methods have been to analysis the data.

(a) The Severity Index for each of the variables will be computed with the following formula Severity Index

$$(S.I) = \frac{\sum_{i=1}^{4} WI * fi * 100}{\sum_{i=1}^{4} fi}$$

Where A is the constant expressing the weighting given to each response, it ranges from 1 Low impact to 3 for high impact; N is the frequency of the responses.

(b) Similarly, the frequency index for each of the variables will be computed with following formula

$$(F.I)(\%) = \frac{\sum_{i=1}^{4} WI * fi * 100}{\sum_{i=1}^{4} fi}$$

Where A is the constant expressing the weighting given to each response, it ranges from 1to low frequency and 3 to high frequency; N is the frequency of the responses.

CHAPTER FOUR
RESEARCH ANALYSIS AND DISCUSSION

4.1 Introduction

Within this section of the research the result of the data analysis gathered from questionnaire survey and unstructured interview were presented, interpreted and analyzed and discussed in detail to justify the existence of the problem, identification of causes and their consequences together and severity of the causes to the projects were discussed in addition to appropriateness of risk allocation mechanism from perspectives of professionals participated in 10/90 and 20/80 condominium projects.

4.2 Questionnaire Survey response rate and Background of respondents

The distribution of the questionnaire achieved to the total of 49 professionals participating in management level of client, contractor and consulting offices. This includes 45 questionnaires to professionals working with contractor, 4 questionnaires to professionals working with consultants and 2 questioners to professionals working with client. From the 49 questionnaire distributed a total of 36 responses were received. These include 32 responses from category of contractor, 2 from the category of consultants and 2 from the category of client. The overall response rate was 73.5 %, which is above the normal range of the questionnaire response rate. The normal range for the response rate in the construction industry is between 20% and 30% (Akintoye, 2000 in Elhag, 2005)

Table 4. Questionnaire distributed vs. Number of Respondents

Stakeholders	Questionnaire distributed	Number of Respondents	Response rate (%)
Contractors	45	32	71.1 %
Consultants	2	2	100%
Clients	2	2	100%
Total	**49**	**36**	**73.5 %**

From the companies surveyed 64% of the respondents were company respondents have 6-10 years' experience in building projects and 34% of the companies have 0-5 years experience in building projects. 85% of the organization have experience of 6-10 in the condominium projects and the remaining 15 % participant's organization have experience of 0-5 years in

these projects. In addition to that more than 90 % of professionals have experience b/n 6-10 years in building projects and 0- 5 years' experience in condominium projects.

4.3 Questions related to awareness and perception

In this section the questions designed to gain generic understanding about perspective and current practice of risk management in Addis Ababa 10/90 and 20/80 condominium projects. The respondents were asked to rate the level, express their agreement and disagreement on the questions and hypothesis from their experience. This approach is used to examine the level of attention given by the practitioners about risk management and to compare the current practice of risk management of the Addis Ababa 10/90 and 20/80 condominium projects with the corresponding theory. This section further indicates the necessary steps towards increasing the risk control and enhancing the achievement of the projects objectives. The response for each questions is analyzed as follows:

Q_1. The respondent were asked if they have formal risk management system

According to the professional's response as indicated in the figure 4 below, none of the companies participated in the 10/90 and 20/80 condominium projects of Addis Ababa use formal risk management system. However, some of the stakeholders such as contractor, consultant and the client manage their own risks informally by unstructured system (the process of listing the risks that may occur and planning how to solve them mainly after it happens based on past experience). Please note that informal way of risk management according to this research is managing risks through unsystematic and unstructured process.

As indicated in the literature part, most of the effects of risks that affect the success of the construction projects occurred due to improper management of the risk. From this we can understand time overrun, cost overrun and quality deviation problems occurred in 10/90 and 20/80 condominium projects of Addis Ababa is due to not properly or formally managing risks by the stakeholders i.e. client, contractors and consultants.

According to a study carried out by Bowers and Khorakian (2014), in most construction industries of developing countries of the world, very little facts on successful implementation of risk management systems is known. In line with this, this research found out the Addis Ababa's 10/90 and 20/80 condominium projects are also unsuccessful in connection with implementing formal risk management.

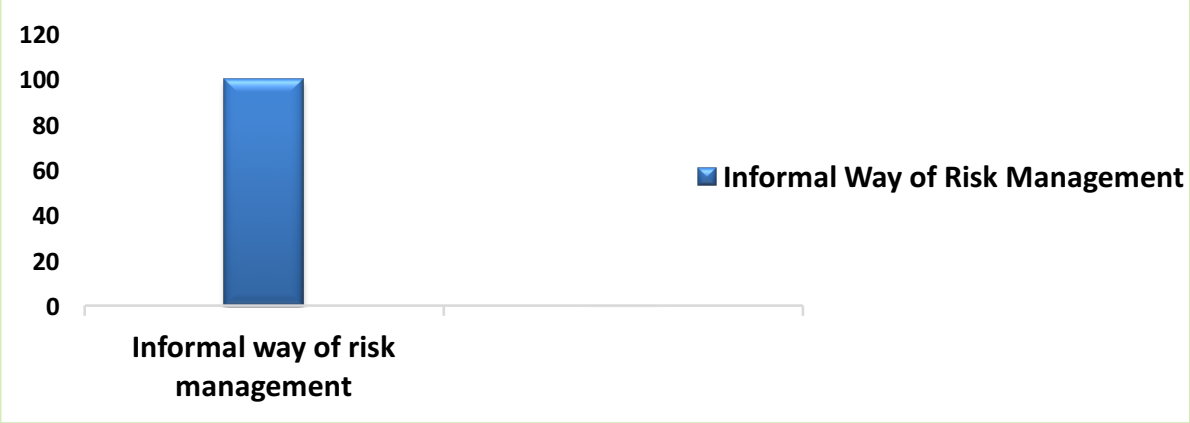

Figure 4. Ways of Risk Management

Q_2. The respondents were asked the basic objective the risk management system in their firm

According to 90% of the respondents said the objective of the informal risk management is usually to manage time and cost related risks, 5% of the respondents include quality related risks with management of time and cost related risks. As per the literature review, risks are generally considered as incidences that influence the principal objectives of a particular project (time, cost, quality) and risk management is the main management tool for the success of the project where the success of the project is measured in terms of attaining the planned cost, time and quality standards. But in the case of Addis Ababa 10/90 and 20/80 condominium projects quality is not planned even in the informal risk management system due to this most of the projects quality standard is very low and mostly they incur rework which cause additional cost and time.

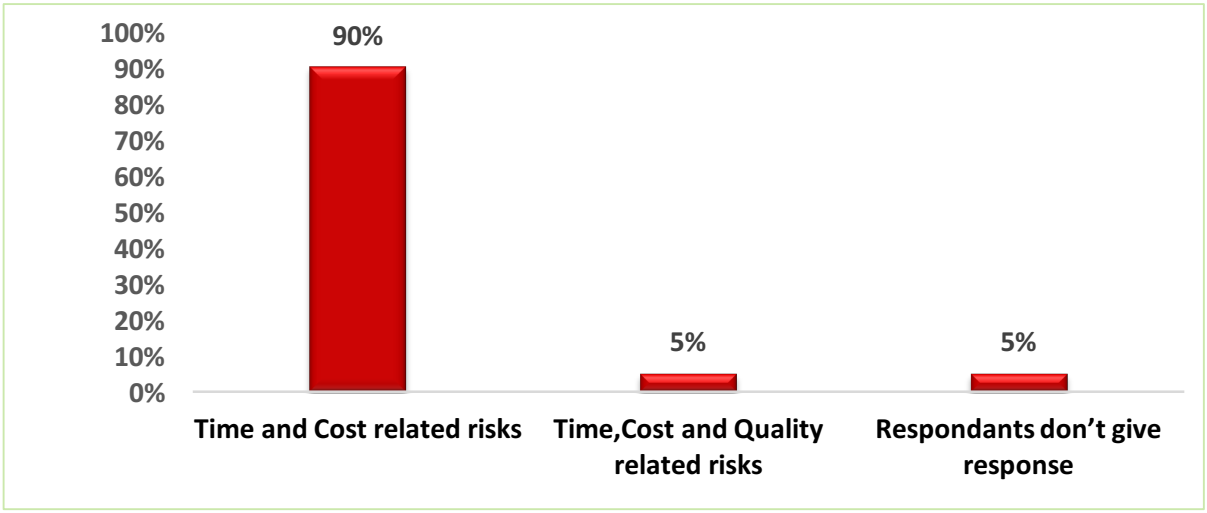

Figure 5. Objectives of risk management

Q_3. The respondents were requested why they don't implement formal risk management system

From literatures Pakistan's construction risk management is reactive, semi-permanent, casual and unstructured within the construction industry, resulting in a lack of capacity to manage risks appropriately. The main barriers that were found for the implementation of an effective risk management system are the lack of formality of the system and the lack of integrative mechanisms of risk management among the parties involved in the projects (Choudhry and Iqbal, 2013). This research indicated in case of Addis Ababa 10/90 and 20/80 condominium projects they are not using formal risk managements system as management tool because of lack of awareness and they think they need to hire other staffs which is additional cost. But cost of managing risk is very low compared to the cost of consequence of not properly managing risk in construction projects.

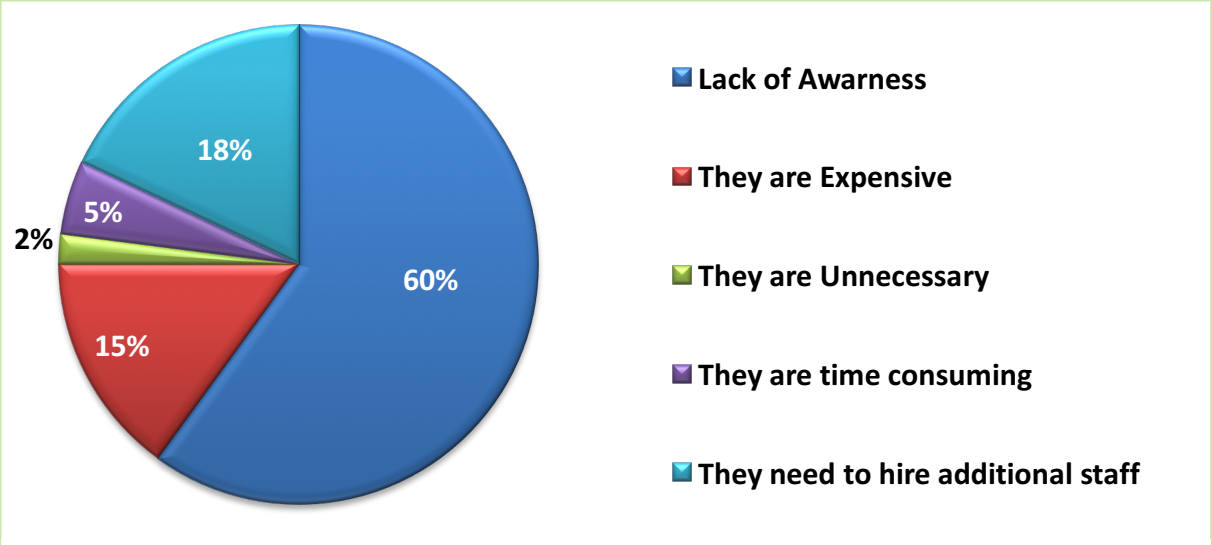

Figure 6. Reasons for not using risk management as management tool

Q_4. The respondents were requested how they rate the knowledge and skill of professionals and decision makers in their organization

As indicated in the figure below, the responses summarized as: Very low 8%, Low 32%, Moderate 60%, High 0% and Very High 0%. This shows that most of the decision makers are not confident enough to rate their risk management knowledge as very good which is an indication of gap of knowledge on the subject of risk management by the decision makers. From this one can conclude that most of poor decisions made by decision makers on regarding attaining project objectives were raised due to low understanding of risk management system.

Hence trainings should be organized and even this topic should be given as a course in high education to increase awareness and to increase involvement of decision makers in risk management to increase efficient and effective implementation of construction projects.

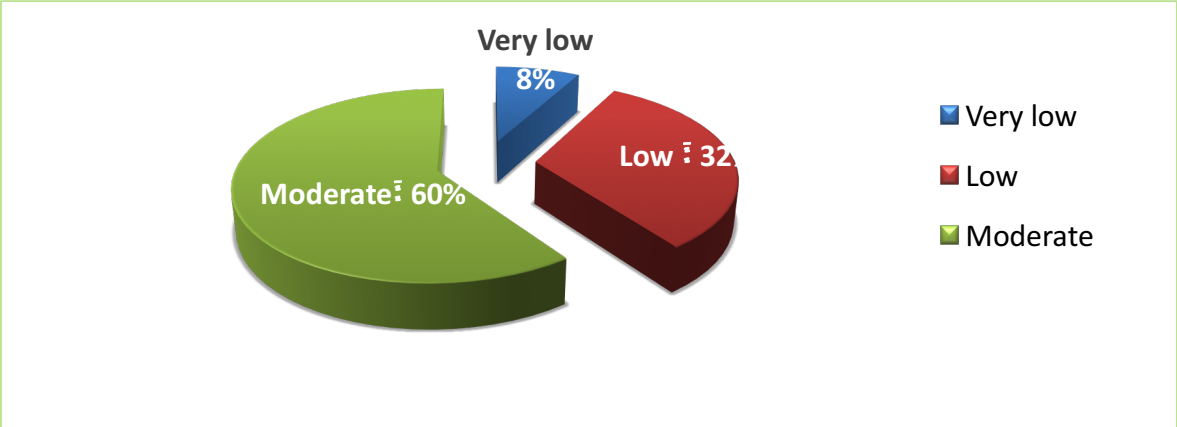

Figure 7. Professionals and decision maker's knowledge regarding risk management

Q_5. The respondents were asked to rate need for risk management training to the construction professionals urgently.

The responses summarized as: Very Low: 0%, Low: 0%, Medium: 4%, High: 14% and Very high82%. The result indicates that the majority of the respondents agreed the construction professionals participated in condominium projects need training in the field of risk management to create good way of creating awareness and making the parties be competent in the principles of risk management.

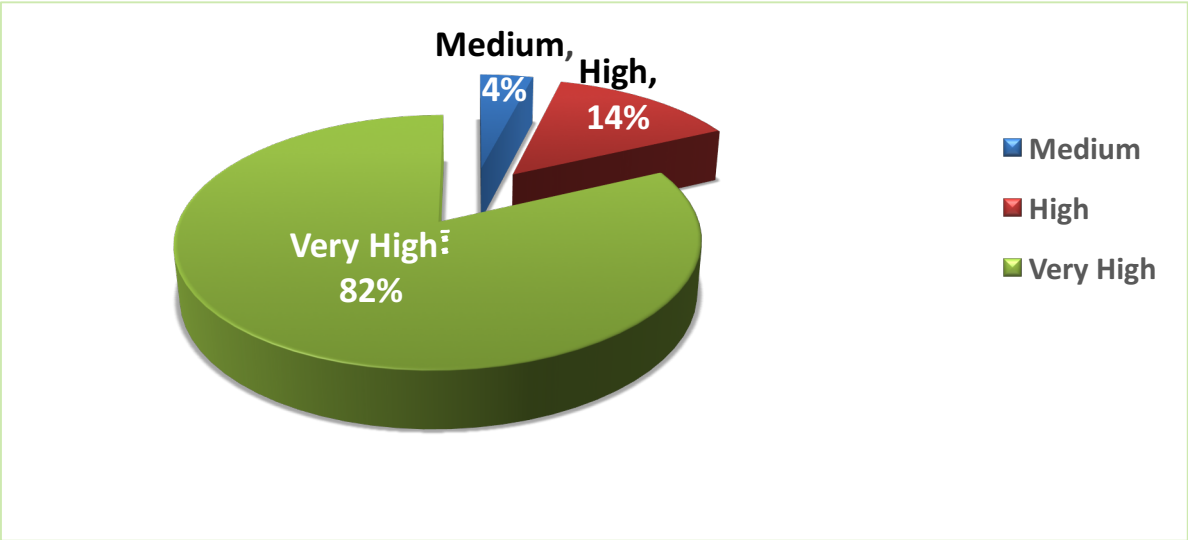

Figure 8. The need for training and workshops on risk management

Q_7. The respondents were asked if they feel risk management can help and add value to their work particularly in managing construction projects.

The responses summarized as: Strongly agree: 66%, Agree: 30%Neutral: 2% Disagree: 2% and 0% Disagree. Most of the respondents strongly agree risk management can help and add value in their work particularly in managing construction projects even if they don't practice it in the formal way fearing the cost of managing the risks. According to the respondent the informal way risk management which is very unstructured process has helped them to manage the risks somehow and they believe if the risks are managed in the formal way through structured process, the objectives of 10/90 and 20/80 condominium projects can be attainted.

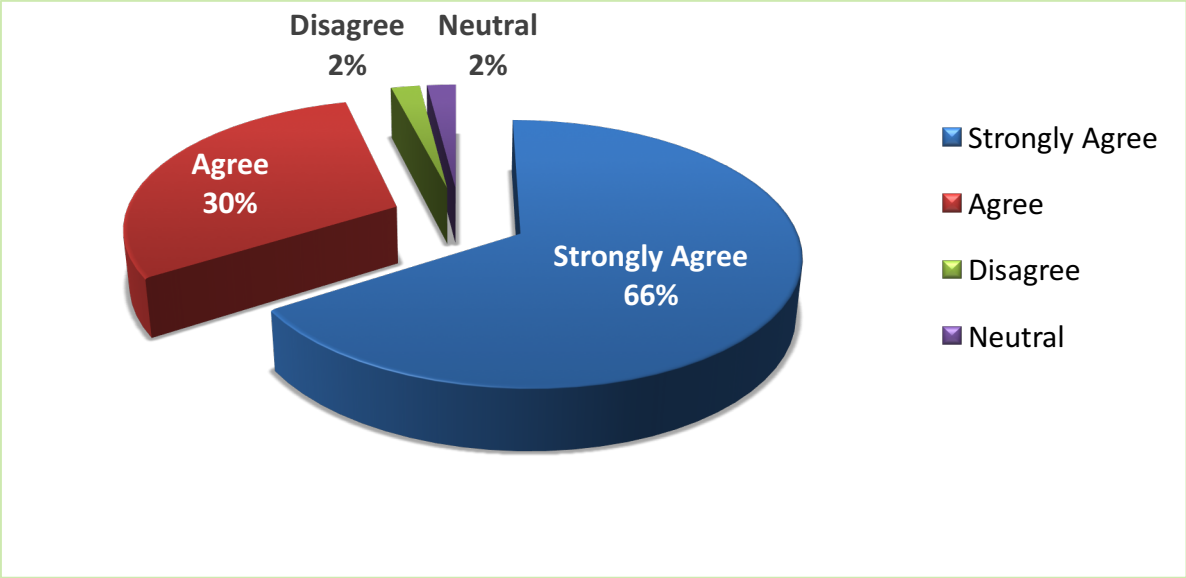

Figure 9. Risk management system adds value in managing construction projects

Q_8. In your opinion do you think lack of proper risk management has significant effect towards achieving the project's (Addis Ababa 10/90 and 20/80 condominium projects) objective particularly cost, time and quality targets?

The responses summarized as: Strongly Agree:80%Agree: 17% Neutral: 3%, Disagree: 0% and strongly disagree: 0%. From the responses of professionals participated in the construction of Addis Ababa 10/90 and 20/80 condominium projects, it can be concluded that lack of formal risk management is one of major problem affecting the projects objective regarding attaining the time, cost and quality targets.

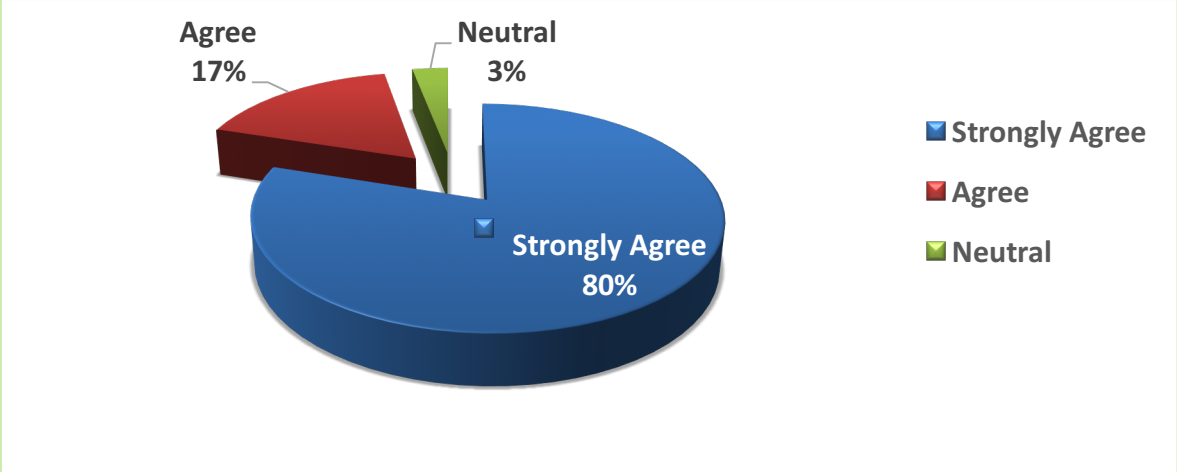

Figure 10. Lack of proper risk management towards achieving the project's objective

Q_9. The respondents were asked about the owners and contractors of the Addis Ababa 20/80 and 10/90 condominium projects has been slowly accepting risk management as a management tool that will help in managing condominium projects effectively?

The responses summarized as: Strongly Agree: 0%, Agree: 25 %, Neutral: 10 %, Disagree: 65% and Strongly Disagree 0%. The majority of the respondent said stakeholders are not accepting risk management to manage risks of condominium projects effectively. Stakeholders primarily contractors and client of Addis Ababa 10/90 and 20/80are not ready to accept formal risk management as one of management tool because they think it is additional cost

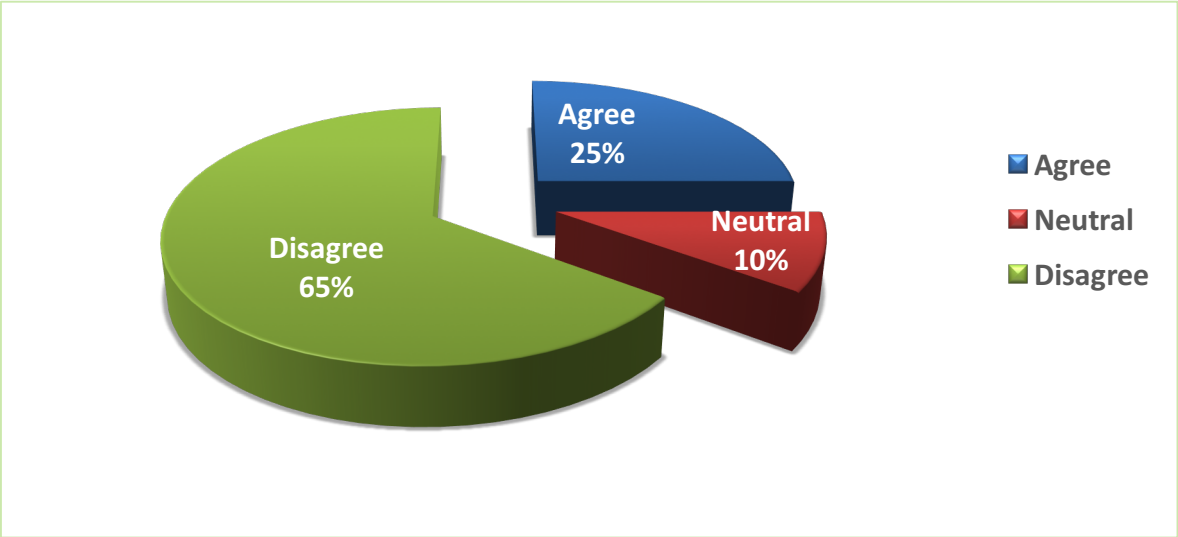

Figure 11. Acceptance of risk management as a management tool as management tool

4.4 **Analysis of Question related to current practice of risk management**

Q_1. The respondents were asked which activity and process of risk management is not widely used in Addis Ababa 10/90 and 20/80 condominium projects? And to give weight with 1 for the least used and 5 for most used

Generally, the contractors, consultants and client participated in Addis Ababa 10/90 and 20/80 condominium projects do not use risk management system in formal and organised way. Since the construction cost of the projects are decided or fixed by the client, risks are counted by contingency fund during fixing the contract prices by the client. But in the case of the consultants the project costs(design cost + supervision cost, sometimes design and supervision service can be given by separate consultants) are decided by bid. Hence, the consultants try to entertain the risks that can be incurred by contingency fund during biding period.

During the execution period of the projects the parties manage risks in very informal way. The respondents agreed risk identification and risk response processes are mostly used by the parties rather than other risk management process i.e. risk classification, risk analysis. Which clearly shows the stakeholders of Addis Ababa 10/90 and 20/80 condominium projects mostly don’t classify risks and analyse risks so that they don't have clear information about risks before they happened to the projects and risk response is not made on clear information

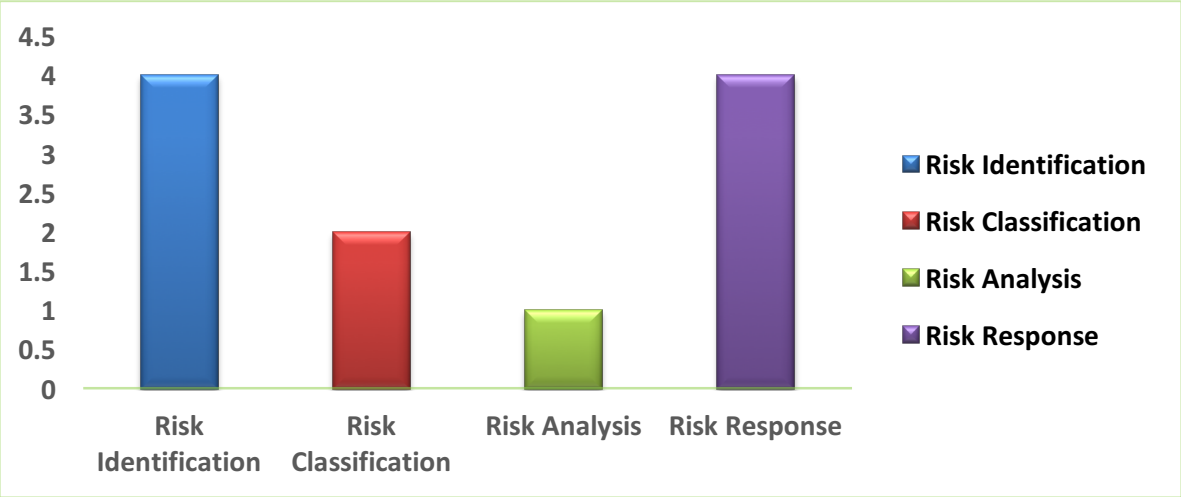

Figure 12. Contractor, client and consultant risk management activity

Q_2. The respondent was asked which risk identification technique is more familiar to their organization. And to give weight with 1 for the least important and 5 for most important

As per the figure below all the three party mostly use checklist as risk identification method but expert opinion is not most used for risk identification by the parities. From this it is clear that the risks are not identified properly and the parties have lost the advantages of utilizing brainstorming, interview and Expert opinion as risk identification techniques

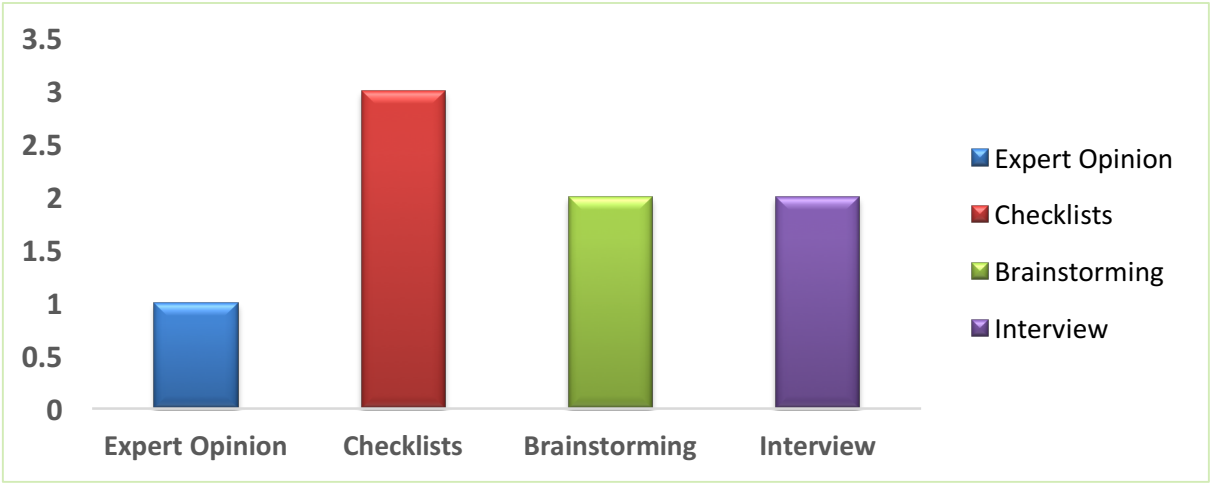

Figure 13. Risk identification methods

Q_3. The respondents asked how they classify risks

All respondent agreed there is no formal or organized way of risk classification method but in the informal way they mostly give attention for risks causing time and cost overrun and the risk factors that compromise quality are not mostly considered even during informal classification of risks. From this we can see most of the quality problems are occurred because of less attention given still during the informal way of risk management.

Q_4. The respondents were asked to prioritize risk analysis techniques familiar to their organizations

The result indicates that individual intuition, judgment and experience gained from previous experience are the familiar type of risk analysis method used by the parties participated in construction of Addis Ababa 10/90 and 20/80 condominium projects. From this we can see the professionals engaging in construction of Addis Ababa 10/90 and 20/80 condominium projects prefer to use qualitative risk analysis method than quantitative risk analysis method. Due to that the consequences of risks if they occurred are not known in figure.

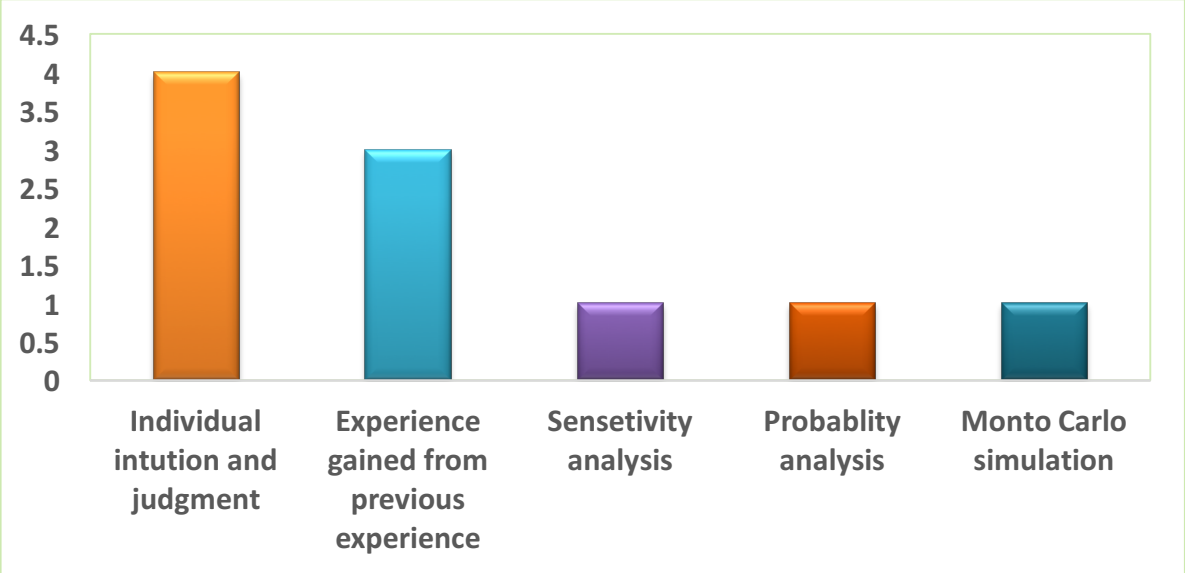

Figure 14. Risk analysis methods used

Q_5. The respondent request which risk response method they mostly use?

According to the respondent they mostly use risk transfer and retention method but risk reduction and avoidance methods are not mostly used for risk response. Since those methods are neglected additional cost and time are incurred for the managing risks that could be avoided or reduced.

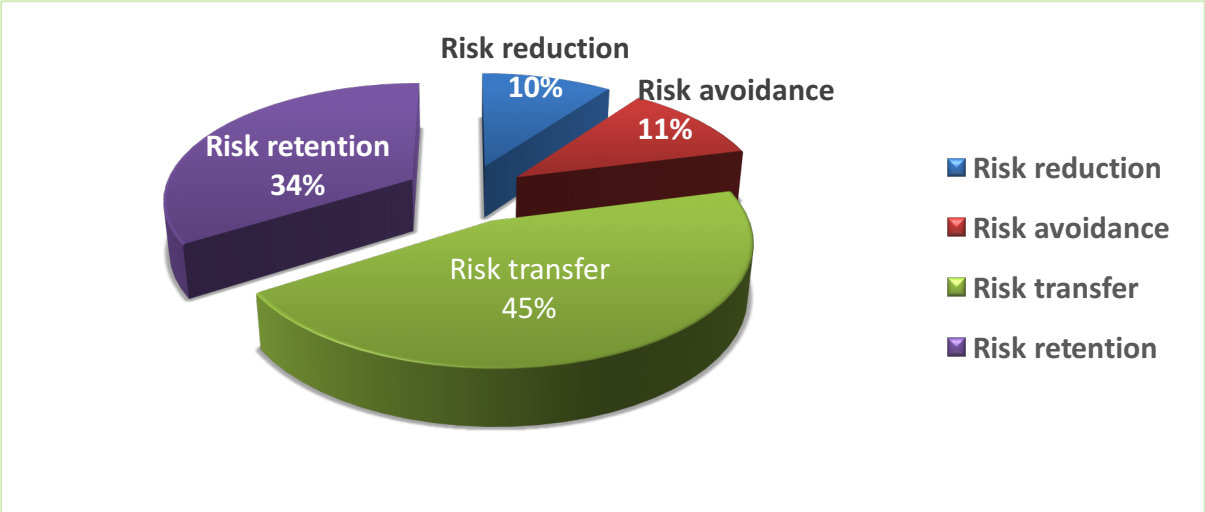

Figure 15. Risk response methods used

Q_6. The respondent requested the tools and techniques used to monitor risks in 10/90 and 20/80 condominium projects?

Most of the respondents said they use status meeting and monitoring of the overall project status to monitor risks but risk reassessment and risk register updates are not the methods that are not used by the respondents. Since risks are not registered there is no way of referring past experience regarding risk response mechanisms. In addition to that new potential risks can cause problems on projects objective attainment because of the risks that are not reassessed.

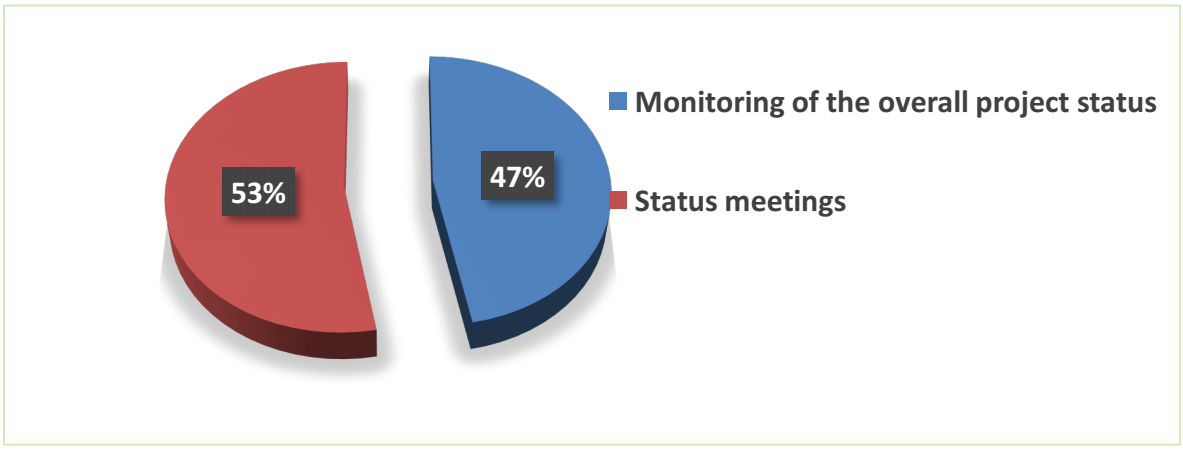

Figure 16. Risk monitoring methods

Q_7. The respondents asked how risks are allocated to different parties involved in a project

All respondents agreed the risks are allocated to the party in the best position to control them through the contract clauses. This method of risk allocation methods are mostly used worldwide.

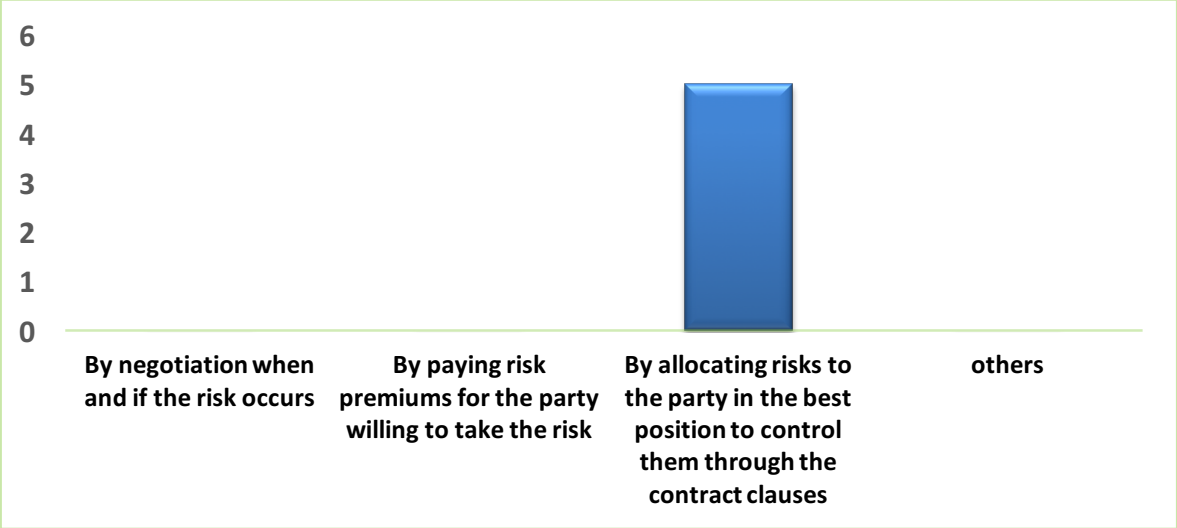

Figure 17. Risk allocation Mechanism

4.5 Ranking of the identified risks

The risk factors (37 factors) are analyzed based on practitioners' opinion and based on the analysis, factors got more than 75% result are identified as frequent and key risk factor causing cost overrun, time overrun and quality deviation. Accordingly, the identified risks are hereunder:

Table 5. Risk factor analysis

Key factor causing Cost overrun	Key factor causing Time overrun	Key factor causing Quality Deviation	Most frequently occurring Risks
* Inflation	* Shortage in material supply	* Failure to identity defects	* Shortage in material supply
* Shortage in material supply	* Shortage in foreign currency	*Inadequate management and planning	*Inadequate management and planning
*Exchange rate fluctuation	* Inflation	*Shortage in manpower and equipment supply	* Inflation
*Inadequate management and planning	* Inappropriate organizational interference	*Poor coordination	* Shortage in foreign currency
* Shortage in foreign currency	*Inadequate management and planning	*Low productivity of labor and equipment	*Exchange rate fluctuation
*Poor coordination	*Exchange rate fluctuation		*Low productivity of labor and equipment
*Low productivity of labor and equipment	*Shortage in manpower and equipment supply		* Inappropriate organizational interference
*Shortage in manpower and equipment supply	* Low productivity of labor and equipment		* Poor coordination
* Failure to identity defects	* Failure to identity defects		* Failure to identity defects
* Inappropriate organizational interference	* Poor coordination		*Shortage in manpower and equipment supply

Due to the vastness of the project and limited time available for the research work only the top ten highly significant risks influencing projects to achieve the objectives in Addis Ababa 10/90 and 20/80 condominium projects are analyzed in detail. The risks are the following:

1. Shortage in material supply
2. Inadequate management and planning
3. Unavailability of foreign currency
4. Exchange rate fluctuation
5. Inflation
6. Low productivity of labor and equipment
7. Shortage in manpower and equipment
8. Poor coordination
9. Failure to identify defects
10. Inappropriate organizational interference

Most Significant risks in Addis Ababa 10/90 and 20/80 Condominium Projects

As shown above, with respect to the frequency of occurrence and degree of impact of the identified risks, all the parties agreed that these risks are most critical in Addis Ababa 10/90 and 20/80 condominium. Brief discussion about the most significant risks presented as follows;

1. Shortage in Material Supply

Researches shows us construction materials constitute 40-60 % of the total construction cost which means in other way proper management of this single largest component can improve the productivity and cost efficiency of the project and help ensure its timely completion.

The materials management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled onsite in a timely manner and at a reasonable cost. It is also a system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most ***importantly are available at the point of use when required.***

But in case of condominium projects the owner who is the supplier of the construction materials as per the contract, usually do not provide the required construction materials at the point of use or when they are required. According to the representatives of the AAHDO, there are times where materials have not provided up to six and eight months. The reason for this is the materials are purchased in bulk and mostly imported from different countries. Which makes the provision of materials dependent on availability of fund and foreign

currency. According to the office they are planning to give the contractor responsibility for supply of materials for the projects. And they have piloted the system where the contractor is responsible for provision of construction materials at Bashawelda and Gelan sites are piloted projects and according to the construction manager of AAHDO this projects are completed before their completion date and as per signed contract amount. From this it is understandable the owner's material procurement and management system is poor.

2. Inadequate Management and Planning

Inadequate management and planning are critical reasons which negatively affect the achievement of objectives in Addis Ababa 10/90 and 20/80 condominium projects. Addis Ababa 10/90 and 20/80 condominium projects do not properly planned at early stage usually the time and cost required for execution are estimated from previous history and they are not specific for the projects. But no two construction projects are exactly the same and vary in many ways such as design, size, capacity, utilities, location, and orientation, and so on. When projects are planned and budgeted based on historical data, it is important to consider the differentiators and variables unique to the project and factor them accordingly.

In addition to that the remoteness of the sites affected the management system. Remote construction projects represent a unique case. These projects have certain characteristics such as they are remote and difficult to access, thus it is difficult to frequently monitor and control the project processes and outcomes, and to provide supplies to the site by the owner. Supervision teams also experience countless difficulties and management problems with respect to the supervision of the site and the contractors affected by the lack of human resources, infrastructure and experience of how to manage these remote projects.

The other thing which makes difficult to manage these projects is that different parties participated, i.e. government bodies, AAHDO, consultants, contractors, electrical and sanitary subcontractors, small and micro enterprises.

3, 4, 5 Exchange Rate Fluctuation, Inflation and Unavailability of Foreign Currency

During the past decade the inflation rate in Ethiopian increased at highest rate plus Ethiopian birr has-been significantly depreciated against major foreign currencies (USD and Euro). For example, the exchange rate of ETB to USD has depreciated from 8.3:1 in 1999/2000 to19.87:1 in 2013/2014 and 28.78: 1 in 2019 (NBE, 2014). Since materials are purchased in bulk and mostly imported from foreign countries exchange rate fluctuation and inflation

increased the cost of materials more than what was expected which highly affect the cost and intended completion date of condominium projects. In addition to that unavailability of foreign currency is the hot issue in Ethiopia which is also the other reason for not purchasing and providing materials timely to construction project sites.

6&7 Shortage in Manpower, Equipment and Low Productivity of Labor and Equipment

Construction projects involve huge input of resources which are primarily materials, manpower and machinery. Good project management in construction must vigorously pursue the efficient utilization of labor and equipment. Improvement of labor productivity should be a major and continual concern of those who are responsible for cost and time control of constructed facilities. The management should be responsible for significant productivity improvement in meeting the predetermined targets. Productivity management includes measuring the actual productivity, comparing with bench marks, identifying the factors affecting the productivity and implementing management tools for improving and increasing the productivity. Productivity Management has to be followed in every level with push from the top level of the project.

But in case of Addis Ababa condominium projects, the productivity of the labor and equipment are very low due to the following reasons

- Since the condominium projects are very far from the city experienced semi- skilled professionals usually don't want work in these projects.
- It is usually very hard to find semi-skilled professionals around the condominium construction sites and they are not experienced.
- Trainings and workshops are not given for less experienced semi- skilled professionals
- Productivity of both equipment and manpower is not managed

8. Poor Coordination

Coordination facilitate the information exchange, chain of command and communication in the construction process. At the same time, coordination reduces the error and discrepancy throughout the overall process, thereby mitigating the likely time delays and incurred cost of

rework. Therefore, coordination between project participants is the most significant factor with the greatest impact on time, cost and quality performance.

Since large numbers of participants have take part to carry out the specific task of the project, Addis Ababa 10/90 and 20/80 condominium projects face poor coordination between the parties. Due to this frequent claims, disputes, delay, rework and additional cost for rework are not new issues for the condominium projects in Addis Ababa

9. Failure to Identify Defects

Most of quality issues occurred in condominium projects is because of not identifying failure of defects. Absence of skilled labor and workmanship is one of the major factor affecting the quality of the works. Besides condominium housing projects required to be performed with minimum cost as possible due to that the skilled labor especially form consultant and contractor part do not have enough experience to perform this type of massive constructions.

10. Inappropriate Organizational Interference

Since these projects are owned by the government, different bodies usually interfered e.g when the budget is required for other most important issue the money may be taken from these projects. The Ministry of Urban Development and Housing said in a 10-month performance report which was submitted to Parliament on June 2017, that the government is eyeing other options due to funding shortage for the projects. It conceded that the ambitious target of building some 750,000 condominiums during the second Growth and Transformation Plan, which comes to an end in 2020, is unattainable its objective regarding time, cost and quality owing to the fact that a budget was not appropriated for the program.

The other case is when the projects were wanted for the political consumption by the government, the Housing office was required to complete the projects within very short period of time. Most of this period quality of the construction works are compromised

4.6 Risk allocation practice from the perspective of the practitioners

Risk allocation is an important issue in risk management. Effective risk management can be achieved as risk allocated to the party who is in the best position to deal with it. This section refers to the proper allocation of risks to the contracting party, mainly the owner or the contractor and sometimes shared, based on the view point of the practitioners. The respondents were requested to comment on the risk allocation practice of Addis Ababa 10/90

and 20 /80 condominium projects whether the allocation practice requires revision for the identified risks.

The Addis Ababa 10/90 and 20/80 condominium projects uses dominantly the risk allocation principles suggested in PPA General Condition of Contract. According to the majority of the view point of practitioners, 3 risks maintained varied frequency more than 80%. This shows that the practitioners recommend revision of risk allocation for these risks based on the context of condominium projects

- Inadequate management and planning
- Owner's unreasonably imposed tight schedule

Inadequate management and planning: according to PPA inadequate management and planning to perform the project is taken as the responsibility of the contractor but in case of condominium projects where materials (more than 40% of the project cost) are provided by the owner, this risks should be shared by the owner and the contractor.

Owner's unreasonably imposed tight schedule: In condominium projects mostly the owner imposed tight schedule to the contractor to complete and hand over to the client whenever the government bodies want them for politics usually at the times of election periods. This is also supported by the condition of contract since it gives right to the engineer to approve the extension of time. But in case of this projects the consultant usually don't have power to not accept what is ordered by the government even if it not viable. Mostly it is not viable to complete these projects at specified time because materials didn't provided at construction site at the time of need during construction work but at those periods where the owner wanted to transfer the projects to the end user the contractor is obliged to complete the works at soonest time.

This shows that the practitioners regarded the management practice of these risks have not been efficient in the condominium construction. Thus, it is suggested to revise allocation practice for these risks to be shared rather than allocated to either party. These risks are causing current conditions of Addis Ababa 10/90 and 20/80 condominium projects.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

Cost overrun, time overrun and quality deviations are the prime problems of the projects in Addis Ababa condominium projects. Not achieving projects objectives is an indication of poor risk managements. Both the employer and contractor are suffering from the unnecessary increased cost and delayed in completion which would have been minimized through taking the necessary steps and implementing effective risk management for every project.

Detail literature review conducted to gain general understanding about the theory and practice of risk management in particular in developing countries. Further overview of the Addis Ababa condominium projects is also conducted. From the literature review, thirty seven project risks are identified and categorized into six groups; Design and tender related risks, Construction related risks, Legal and contractual related risks, Finance related risks, Political and Logistic related risks, and Physical, Natural, Operational and Environmental related risks based on their source.

Descriptive method of research selected as it is more appropriate for the nature and type of research question. The questionnaire and unstructured interview survey was used to collect professionals' opinion participating in Addis Ababa 10/90 and 20/80 condominium projects Questions are aimed to acquire the data required to analyze the concepts and to address the objective of the research.

The response rate of the questionnaire is 73.5% which is more than the normal ratei.e.30% required for conducting construction research analysis according to Akintoye. Then, appropriate statistical data analysis adopted to compute the frequency, severity and importance indices of each risk according to the data collected from different groups of respondents. Then, risk ranking was conducted based on the respective frequency and severity index after that the risk that are frequent same time severe with index more than 75% are analyzed. This implies that these risks are frequent and have higher level of influence on the project objectives in terms of cost and time performance.

CONCLUSIONS

1. Though the benefits of risk management are acknowledged by the professionals in Addis Ababa 10/90 and 20/80 condominium projects, there is still lack of formalized risk management mechanisms such as risk identification, classification, analysis, response and monitoring. The methods used to deal with risks in Addis Ababa condominium projects is more of informal approach (highly dependent on individual's judgment and past experience). This is mainly because of lack of awareness, fear of incurring additional cost to manage the risks and lack of familiarity and knowledge about risk management among the professionals in the industry.

   The Addis Ababa 10/90 ad 20/80 condominium projects are no more effective through traditional approach since the effect of not managed risks are highly affecting the success of the projects in terms of cost, time and quality deviations.
2. The top ten significant risks influencing the project's cost, time and quality performance in the Addis Ababa 10/90 and 20/80 condominium projects are: shortage in material supply, inadequate management and planning, unavailability of foreign currency, exchange rate fluctuation, Inflation, low productivity of labor and equipment, shortage in manpower and equipment, poor coordination and failure to identify defects and inappropriate organizational interference. The majority of the top ten risks were Construction, Finance, Political and Logistic related risks in Addis Ababa 10/90 and 20/80 condominium projects.
3. It is also revealed that the risk allocation practice of the Addis Ababa 10/90 and 20/80 condominium projects is found to be in line with the risk principle for the majority of identified risks i.e. risks should be allocated to the party who is in the best position deal with it. But for some identified risks the allocation of risk should be shared between the contractor and client on the context of Addis Ababa 10/90 and 20/80 condominium projects. It is because construction materials except sand are provided by the client, any consequence incurred due to improper planning and management should be shared by the client and the contractor.

RECOMMENDATIONS

Finally, the following recommendations were made to foster the application of risk management in 10/90 and 20/80 condominium projects of Addis Ababa.

1. It is necessary to implement well established and formal risk management system in Addis Ababa 10/90 and 20/80 condominium projects so that the risk will be identified, classified, analysed and appropriate responses will be issued which will help to minimize the negative effect of risks on the project objectives.
2. It is required to give the necessary training and workshop to the construction professionals to improve their knowledge about risk management and to foster the risk culture in the industry. Trainings help to change the attitude of the professionals to be positive to risk management and to change their perspective about risk management and to install long term benefits. To this end, a lot of work is expected from the Consultant and Contractors as well as from Addis Ababa Housing and Development program. It is also useful if the subject is included in the curriculum of universities.
3. Shortage of material supply is most significant factor in condominium projects and it is the responsibility of the client to provide construction material for all project sites. But it seems planning and coordinating construction materials for the projects is not an easy job for the client due to the vastness of the projects. Hence, I recommend it to be the responsibility of the contractors since they know the required materials in detail in terms of type and quantities in addition to that coordination job will be distributed to the number of contractors.
4. To decrease the type and quantities of materials imported from foreign countries i.e. most of electrical and sanitary materials, the government/ the owner should aid research and development centers so that this centers will discover cost reducing construction materials produced from easily available materials.
5. Incentive mechanisms should be planned so that so that experienced professionals will be eager to participate on this projects.
6. If the responsibility of provision of construction materials is still the responsibility of the client, the risks occurred due to inadequate management and planning should be shared.

Recommendation for further research: Further research need to be done to see the economic advantage of effective risk management to the condominium projects.

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APPENDIX

Questioner

General information

The objective of this research is to assess the current risk management culture, understand the various risk factors causing time overrun, cost overrun and quality deviation, and assess appropriateness of risk allocation methods from perspective of professionals and recommend possible solutions based on research findings.

The purpose of this survey is to obtain data for the specified research conducted as a partial fulfillment of MENG Degree in Construction Technology and Management at Addis Ababa University and the data obtained from the survey will be held confidential and it is used for only academic purpose.

1. For the purpose of this research risk is uncertain event or condition that, if it occurs has negative effect on project objective
2. Your open and prompt response is highly essential to fulfill the objective of this research and to address the problem
3. For any further information the researcher can be reached through

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THANK YOU VERY MUCH!

Section 1: Company and Respondent profile

1.1 Please provide the following information about your professional and organizational profile by marking (X) in the space provided.

Name of your organization (optional)_____

Some of the projects participated in _____

Type or origin of your organization		Your firm experience in				Your position in the organization	Your professional experience in			
		Building Projects		Condominium projects			Building Projects		Condominium Projects	
Client/Employer		0-5 years		0-5 years			0-5 years		0-5 years	
Consultant		6-10 years		6-10 years			6-10 years		6-10 years	
Contractor		10-15 years		10-15 years			10-15 years		10-15 years	
Others (specify)……		More than 20		More than 20			More than 20		More than 20	

Section 2: Questions Related to Awareness and Perception

2.1 Do you have a formal risk management system in your firm?

( ) **Yes** ( ) **No**

2.2 [If yes] what is the basic objective of the risk management system in your firm?

_____

2.3 What methods / risk management process do you use to deal with different risks that arise from10/90 and 20/80 condominium projects?

2.4 If your answer to (Q. 2.1) is no, What is the reason for not implementing formal risk management system (you can tick more than one box)

( ) Lack of awareness ( ) They are expensive

( ) They are unnecessary ( ) They are time consuming

( ) They need to hire additional staff ( ) Others, please specify _____

2.5 How do you rate the knowledge and skill of professionals and decision makers about risk management in your organization/ the construction industry?

Very low ( ) **Low** ( ) **Moderate** ( ) **High** ( ) **Very High** ( )

2.6 How do you rate your experience in participating risk management on your job?

Very low ( ) **Low** ( ) **Moderate** ( ) **High** ( ) **Very High** ( )

2.7 How do you rate the need for risk management training and workshops to the construction professionals urgently?

Very low ( ) **Low** ( ) **Moderate** ( ) **High** ( ) **Very High** ( )

2.8 In your opinion do you think risk management can help and add value to your work particularly in managing construction projects?

Strongly Agree ( ) **Agree** ( ) **Neutral** ( ) **Disagree** ( ) **Strongly disagree** ( )

2.9 In your opinion do you think lack of proper risk management has significant effect towards achieving the project's (Addis Ababa 10/90 and 20/ 80 condominium projects) objective particularly cost, time and quality targets?

Strongly Agree ( ) **Agree** ( ) **Neutral** ( ) **Disagree** ( ) **Strongly disagree** ( )

2.10 In your opinion do you think the owners and contractors of the Addis Ababa 20/80 and 10/90 condominium projects has been slowly accepting risk management as a management tool that will help in managing condominium projects effectively?

Strongly Agree ( ) **Agree** ( ) **Neutral** ( ) **Disagree** ( ) **Strongly disagree** ( )

Section 3: Practice of Risk Management

3.1 In your opinion which process of risk management framework is not widely used in Addis Ababa 20/80and 10/90 condominium projects (please give weight with 1 for the least used and 5 for most used)

Risk identification ( ) **Risk Classification** ( ) **Risk Analysis** ( ) **Risk Response** ( ) Others, please specify _____

3.2 Which risk identification technique is more familiar to your organization? (please give a weight with 1 for the least important to 5 for most important)

Expert Opinion ( ) **Checklists** ( ) **Brainstorming** ( ) **Interview** ( )

Others, please specify_____

3.3 How do you classify risks during risk management of 10/90 and 20/80 condominium project?

_____

_____

3.4 Which risk analysis technique is more familiar to your organization? (please give a weight with 1 for the least important to 5 for most important)

( ) using individual intuition and judgment
( ) Experience gained from previous experience
( ) Sensitive analysis
( ) Probability analysis
( ) Monte Carlo simulation
( ) Others (please specify)_____

3.5 Which risk response strategy do you usually use? (please give a weight with 1 for the least important to 5 for most important)

( ) Control/reduction ( ) Avoidance ( ) Transfer/deflect ( ) Retention/acceptance ( ) Other, please specify_____

3.6 What are the tools and techniques used to monitor risks in 10/90 and 20/80 condominium projects?

( ) Risk reassessment – identification of new potential risks, this is a constantly repeated process throughout the whole project.

( ) Monitoring of the overall project status – are there any changes in the project that can effect and cause new possible risks?

( ) Status meetings - discussions with stakeholders and share experience to manage risks

( ) Risk register updates

3.7 How do you allocate risks to the different parties involved in a project?

( ) By negotiation when and if the risk occurs

( ) By paying risk premiums for the party willing to take the risk

( ) By allocating risks to the party in the best position to control them through the contract clauses

( ) Others, please specify _____

Section 4: Assessment of Degree of Frequency of Occurrence and Impact of Identified Risks

I/N	Identified Risks	Frequency of Occurrence			Contribution to Cost			Contribution to Time			Contribution to Quality		
		3	2	1	H	M	L	H	M	L	H	M	L
	Design and tender related risks												
1	Defective design												
2	Drawings and documents are not issued on time												
3	Poor definition of scope of work owner												
4	Change of design required by owners												
5	Poor cost estimate												
6	Budget based on incomplete data;												
7	Unfairness in tendering												
	Construction related risks												
8	Accident in construction												
9	Failure to identify defects												
10	Inadequate management and planning												
11	Feasibility of construction method												
12	Poor coordination												
13	Unpredicted technical problems in construction												
14	Material quality												
15	Low productivity of labour and equipment												
16	High quantity variation												
17	Inappropriate organizational interferance												
18	Unavailability of infrastructure												

19	Unavailability of Water and Electricity												
	Legal and contract related risks												
20	Claims and disputes												
21	Delays in resolving contractual issues and disputes												
22	Customs and duty problems												
	Financial related risks												
23	Availability of funds												
24	Owners' delayed payment to contractors												
25	Inflation												
26	Exchange rate fluctuation												
27	Shortage in foreign currency												
	Political and Logistic related risks												
28	War threats and political instability												
29	Corruption and bribes												
30	Changes in laws and regulations												
31	Shortage in material supply												
32	Shortage in manpower and in equipment supply												
33	loss or damage in transportation												
	Physical, Natural, Operational and Environmental related risks												
34	Unexpected inclement weather												
35	Earth quack, landslide , flood and fire												
36	Loss or damage by fire												
37	Ecological damage and pollution												

Section 5: Assessment of the Allocation of Risks to the Appropriate Parties

I/N	Identified Risks	Allocation of risks based on contract document	Opinion about the Allocation of Risk to			
			Owner	Contractor	Shared	Remark
1	Defective design	Owner				
2	Drawings and documents are not issued on time	Owner				
3	Poor definition of scope of work	Owner				
4	Incompetence of contractor	Contractor				
5	Poor Quality of Work	Contractor				
6	Owners' unreasonably imposed tight schedule	Contractor				
6	Accident in construction	Contractor				
7	Failure to identify defects	Contractor				
8	Inadequate management and planning	Contractor				
9	Feasibility of construction method	Contractor				
10	Poor coordination	Contractor				
11	Unpredicted technical problems in construction	Contractor				
12	Unforeseen Condition	Owner				
13	Material quality	Owner				
14	Low productivity of labour and equipment	Contractor				
15	High quantity variation	Owner				
16	Conflict in documents	Owner				
17	Stakeholders disputes	Owner				
18	Customs and duty problems	Owner				
19	Availability of funds	Owner				
20	Owners' delayed payment to contractors	Owner				
21	Inflation	Owner				
22	Shortage in foreign currency	Owner				
23	War threats and political instability	Owner				

24	Shortage in material supply	Owner				
25	Shortage in manpower and in equipment supply	Contractor				
26	loss or damage in transportation	Owner				
27	Unexpected inclement weather	Owner				
28	Earth quack, landslide , flood and fire	Owner				

Section 6: Analysis of Degree of Severity of Identified Risks on Cost of the Project

I/N	Identified Risks	Impact to Cost			Total Response	Severity Index	Rank
		3	**2**	**1**	**36**		
	Design and tender related risks						
1	Defective design	14	11	11	36	69%	
2	Drawings and documents are not issued on time	2	30	4	36	65%	
3	Poor definition of scope of work owner	3	10	23	36	48%	
4	Change of design required by owners	0	11	25	36	44%	
5	Poor cost estimate	18	6	12	36	72%	
6	Budget based on incomplete data;	12	9	14	35	65%	
7	Unfairness in tendering	2	10	22	34	47%	
	Construction related risks						
8	Accident in construction	3	8	24	35	47%	
9	Failure to identify defects	15	17	4	36	77%	8
10	Inadequate management and planning	32	4	0	36	96%	3
11	Feasibility of construction method	2	18	14	34	55%	
12	Poor coordination	27	7	2	36	90%	5
13	Unpredicted technical problems in construction	4	24	8	36	63%	
14	Material quality	8	17	10	35	65%	
15	Low productivity of labour and equipment	21	19	0	40	84%	6

16	High quantity variation	11	15	8	34	70%	
17	In appropriate organizational interface	15	16	6	37	75%	9
18	Unavailability of infrastructure	10	15	10	35	67%	
19	Unavailability of Water and Electricity	9	14	12	35	64%	
	Legal and contract related risks						
20	Claims and disputes	0	14	22	36	46%	
21	Delays in resolving contractual issues and disputes	4	20	12	36	59%	
22	Customs and duty problems	14	12	10	36	70%	
	Financial related risks						
23	Availability of funds	9	25	2	36	73%	
24	Owners' delayed payment to contractors	5	25	6	36	66%	
25	Inflation	34	2	0	36	98%	1
26	Exchange rate fluctuation	33	3	0	36	97%	2
27	Shortage in foreign currency	30	6	0	36	94%	4
	Political and Logistic related risks						
28	War threats and political instability	6	10	20	36	54%	
29	Corruption and bribes	10	18	8	36	69%	
30	Changes in laws and regulations	7	25	4	36	69%	
31	Shortage in material supply	34	2	0	36	98%	1
32	Shortage in manpower and in equipment supply	20	9	7	36	79%	7
33	loss or damage in transportation	1	29	6	36	62%	
	Physical, Natural, Operational and Environmental related risks						
34	Unexpected inclement weather	0	7	29	36	40%	
35	Earth quack, landslide , flood and fire	0	1	35	36	34%	
36	Loss or damage by fire	0	0	36	36	33%	
37	Ecological damage and pollution	0	0	36	36	33%	

Section 7: Analysis of of Degree of Severity of Identified Risks on time of the project

I/N	Identified Risks	Impact to Time			Total Response	Severity Index	Rank
		3	**2**	**1**	**36**		
	Design and tender related risks						
1	Defective design	9	5	9	23	67%	
2	Drawings and documents are not issued on time	11	10	15	36	63%	
3	Poor definition of scope of work owner	14	10	12	36	69%	
4	Change of design required by owners	5	8	23	36	50%	
5	Poor cost estimate	5	30	1	36	70%	
6	Budget based on incomplete data;	13	10	10	33	70%	
7	Unfairness in tendering	0	9	27	36	42%	
	Construction related risks			22			
8	Accident in construction	4	10	22	36	50%	
9	Failure to identify defects	22	8	5	35	83%	7
10	Inadequate management and planning	30	4	2	36	93%	3
11	Feasibility of construction method	5	20	11	36	61%	
12	Poor coordination	22	8	5	35	83%	7
13	Unpredicted technical problems in construction	4	26	4	34	67%	
14	Material quality	14	12	10	36	70%	
15	Low productivity of labour and equipment	27	7	5	39	85%	6
16	High quantity variation	7	14	15	36	59%	
17	In appropriate organizational interface	30	4	2	36	93%	3
18	Unavailability of infrastructure	8	4	22	34	53%	
19	Unavailability of Water and Electricity	11	18	7	36	70%	
	Legal and contract related risks						
20	Claims and disputes	6	10	20	36	54%	
21	Delays in resolving contractual issues and disputes	5	8	22	35	50%	
22	Customs and duty problems	4	12	18	34	53%	
	Financial related risks						

23	Availability of funds	16	10	9	35	73%	
24	Owners' delayed payment to contractors	8	5	23	36	53%	
25	Inflation	29	5	1	35	93%	3
26	Exchange rate fluctuation	27	8	0	35	92%	4
27	Shortage in foreign currency	33	1	1	35	97%	2
	Political and Logistic related risks						
28	War threats and political instability	6	10	20	36	54%	
29	Corruption and bribes	10	18	8	36	69%	
30	Changes in laws and regulations	7	25	4	36	69%	
31	Shortage in material supply	34	2	0	36	98%	1
32	Shortage in manpower and in equipment supply	25	12	2	39	86%	5
33	loss or damage in transportation	1	29	6	36	62%	
	Physical, Natural, Operational and Environmental related risks						
34	Unexpected inclement weather	0	7	29	36	40%	
35	Earth quack, landslide , flood and fire	0	1	35	36	34%	
36	Loss or damage by fire	0	0	36	36	33%	
37	Ecological damage and pollution	0	0	36	36	33%	

Section 8: Assessment of Degree of Severity of Identified Risks on Quality of the project

I/N	Identified Risks	Impact to Quality			Total Response	Severity Index	Rank
		3	2	1	36		
	Design and tender related risks						
1	Defective design	10	15	10	35	67%	
2	Drawings and documents are not issued on time	0	16	20	36	48%	
3	Poor definition of scope of work by owner	12	10	14	36	65%	
4	Change of design required by owners	3	11	22	36	49%	
5	Poor cost estimate	0	27	9	36	58%	
6	Budget based on incomplete data;	8	25	2	35	72%	
7	Unfairness in tendering	8	19	8	35	67%	
	Construction related risks						
8	Accident in construction	10	16	7	33	70%	
9	Failure to identify defects	32	4	0	36	96%	1
10	Inadequate management and planning	29	5	1	35	93%	2
11	Feasibility of construction method	3	16	14	33	56%	
12	Poor coordination	15	17	2	34	79%	4
13	Unpredicted technical problems in construction	13	14	8	35	71%	
14	Material quality	10	14	12	36	65%	
15	Low productivity of labour and equipment	16	14	4	34	78%	5
16	High quantity variation	10	17	8	35	69%	
17	In appropriate organizational interface	10	10	16	36	61%	
18	Unavailability of infrastructure	10	12	12	34	65%	
19	Unavailability of Water and Electricity	12	12	12	36	67%	
	Legal and contract related risks						
20	Claims and disputes	14	12	10	36	70%	
21	Delays in resolving contractual issues and disputes	6	10	20	36	54%	
22	Customs and duty problems	0	10	36	46	41%	
	Financial related risks						
23	Availability of funds	2	10	24	36	46%	

24	Owners' delayed payment to contractors	3	19	14	36	56%	
25	Inflation	0	6	30	36	39%	
26	Exchange rate fluctuation	0	1	35	36	34%	
27	Shortage in foreign currency	0	1	35	36	34%	
	Political and Logistic related risks						
28	War threats and political instability	6	10	20	36	54%	
29	Corruption and bribes	10	18	8	36	69%	
30	Changes in laws and regulations	7	25	4	36	69%	
31	Shortage in material supply	11	13	12	36	66%	
32	Shortage in manpower and in equipment supply	17	18	1	36	81%	3
33	loss or damage in transportation	1	29	6	36	62%	
	Physical, Natural, Operational and Environmental related risks						
34	Unexpected inclement weather	0	7	29	36	40%	
35	Earth quack, landslide , flood and fire	0	1	35	36	34%	
36	Loss or damage by fire	0	0	36	36	33%	
37	Ecological damage and pollution	0	0	36	36	33%	

Section 9: Assessment of Degree of Frequency of Occurrence of Identified Risks

I/N	Identified Risks	Frequency of Occurrence			Total Response	Frequency Index	Rank
		3	2	1	36		
	Design and tender related risks						
1	Defective design	14	14	8	36	72%	
2	Drawings and documents are not issued on time	2	28	6	36	63%	
3	Poor definition of scope of work owner	3	10	23	36	48%	
4	Change of design required by owners	0	11	25	36	44%	
5	Poor cost estimate	1	29	6	36	62%	
6	Budget based on incomplete data;	8	16	16	40	60%	
7	Unfairness in tendering	2	6	27	35	43%	
	Construction related risks						
8	Accident in construction	9	19	4	32	72%	
9	Failure to identify defects	18	10	6	34	78%	8
10	Inadequate management and planning	33	3	1	37	95%	2
11	Feasibility of construction method	5	20	11	36	61%	
12	Poor coordination	20	14	2	36	83%	7
13	Unpredicted technical problems in construction	4	24	8	36	63%	
14	Material quality	8	16	10	34	65%	
15	Low productivity of labour and equipment	28	6	2	36	91%	5
16	High quantity variation	4	24	8	36	63%	
17	Inappropriate organizational interferance	26	8	2	36	89%	6
18	Unavailability of infrastructure	15	10	10	35	71%	
19	Unavailability of Water and Electricity	13	14	10	37	69%	
	Legal and contract related risks						

20	Claims and disputes	7	21	6	34	68%	
21	Delays in resolving contractual issues and disputes	7	25	2	34	72%	
22	Customs and duty problems	4	26	6	36	65%	
	Financial related risks						
23	Availability of funds	9	22	5	36	70%	
24	Owners' delayed payment to contractors	10	15	9	34	68%	
25	Inflation	32	2	2	36	94%	3
26	Exchange rate fluctuation	30	3	2	35	93%	4
27	Shortage in foreign currency	30	4	2	36	93%	4
	Political and Logistic related risks						
28	War threats and political instability	6	10	20	36	54%	
29	Corruption and bribes	10	18	8	36	69%	
30	Changes in laws and regulations	7	25	4	36	69%	
31	Shortage in material supply	34	2	0	36	98%	1
32	Shortage in manpower and in equipment supply	15	14	5	34	76%	9
33	loss or damage in transportation	1	29	6	36	62%	
	Physical, Natural, Operational and Environmental related risks						
34	Unexpected inclement weather	0	7	29	36	40%	
35	Earth quack, landslide , flood and fire	0	1	35	36	34%	
36	Loss or damage by fire	0	0	36	36	33%	
37	Ecological damage and pollution	0	0	36	36	33%	