SOFTWARE RISK MANAGEMENT PRACTICE IN ETHIOPIA

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DECLARATION

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I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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DATE

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ABSTRACT

In a country like Ethiopia, where information and communication systems are in the early stage of development, software projects may face several challenges. Projects may suffer from schedule or budget overrun or unmet specifications, leading to failure. Risk is one of the factors that challenges project performance, and even causes failure. Hence, risk management helps project managers to control the effect of risks. However, risk management appears to be the least practiced component of project management.

This study aims at assessing the risk management practice in the Ethiopian software projects.

This study was undertaken using a survey conducted on 45 banks, insurance companies and UN agency offices in Addis Ababa, Ethiopia. The findings of the study suggest that formal risk management is not widely practiced in Ethiopian software projects. Only 16% of organisations reported that they applied one or more documented formal risk management techniques. Overall, 67% of organisations were found to exercise one or more risk management process steps. Though the risk management practice was found to be reasonably high, the proportion of organisations that carry out all the risk management process phases, through formal or informal methods, was only 27%, showing that risk management practice in Ethiopia cannot be considered adequate. The study thus recommends that Ethiopian software project managers should give more emphasis for risk management in their project management.

The risk items that Ethiopian software projects face most were found to be technical complexity risks, with the highest risk item being use of new technology. This may be an indication that project managers should give adequate attention to the risks arising from technical complexity. No statistically significant relationship was observed between formal risk management and project success, and also between risk management practice and project success.

KEYWORDS: Addis Ababa; Ethiopia; formal risk management, project success; risk; risk dimension; risk management; risk management practice; software project.

ACRONYMS AND ABBREVIATIONS

APM	Association for Project Management
CMMI	Capability Maturity Model Integration
ETB	Ethiopian Birr (currency)
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
UN	United Nations
UNECA	United Nations Economic Commission for Africa

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Many authors describe risk as a threat that can affect success of projects if not addressed well. Risk refers to an unprecedented event or condition that can arise at any phase of a project and affect the outcome. It can be one of the major factors causing projects to fail (Bannerman 2008:2119; Royer 2000:6). Bhatia and Kapoor (2011:1) describe risk as "a problem that can threaten the success of the software project but has not happened yet." Risk can arise during any phase of a project and require careful management and mitigation at all phases of the project implementation (Bhatia & Kapoor 2011:1, López & Salmeron 2012a:363).

Others argue that risks are not always threats that result in damage to projects. Rather, risks can bring about both adverse and favourable effects on projects. According to the Project Management Body of Knowledge (PMBOK) definition, "Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective" (PMI 2004:7).

In order to minimize or avoid probability and impact of potential damage from risks while maximizing the probability and impact of their potential opportunities, risks must be well managed. Controlling the likelihood of happening and magnitude of impact of risks cannot be attained without a sound risk management process. Inability to control risks would lead to failure to control the outcome of the project (Roy 2004:1; Tesch, Kloppenborg & Frolick 2007:62).

Risk management defines the strategies, tools and methods used to identify and control or manage risks. It is considered to be an important component of software project management that allows controlling occurrence and impact of risks (Alhawari,

Karadsheh, Nehari & Mansour 2012:50-51; Bannerman 2008:2119-2120; Marcelino-Sádaba, Pérez-Ezcurdia, Lazcano & Villanueva 2014:329). Because risk management allows controlling the effect of risks in projects, the literature suggests that it contributes to the success of projects (Bannerman 2008:2118; Bhatia & Kapor 2011; Kwak & Stoddard 2004:916).

However, studies identify risk management as the least practiced component of project management. Many organisations leave out risk management from their software development projects (Mnkandla 2012:279; Royer 2000:6; Sanchez, Robert, Bourgault & Pellerin 2009:19). Emphasizing the contribution of poor practice of risk management to project failures, Boehm (1991:32) suggests that "their problems could have been avoided or strongly reduced if there had been an explicit early concern with identifying and resolving their high-risk elements".

A number of factors contribute to the minimal practice of risk management. Project managers focus more on components whose effect can easily be measured, such as time and budget, than risks. Additionally, risk management is considered as extra cost and work. Project managers prefer to go ahead with implementing their project than spending time, energy and resources to contemplate on what could go wrong. Besides, the control risk management puts in projects is sometimes taken by managers as inhibiting creativity. (Kwak & Stoddard 2004:916; Papke-Shields, Beise & Quan 2010:654-659, Tianyin 2011:2980).

The research problem for this study originates from the investigator's observations of several software project failures in Ethiopia. The research on risk and risk management practice in Australia by Bannerman (2008) and an evaluation of risk management in South African software projects by Wet and Visser (2013) have also instigated the enthusiasm to assess the risk management practice in the Ethiopian software projects.

Bannerman found that only 29% (N=17) of the Australian organisations under study practiced formal risk management and 41% practiced semi-formal or informal management of risks. The remaining 29% have never exercised risk management at all (Bannerman 2006:2124). Wet and Visser's study implies that the software risk

management practice in the South African organisations does not comply with formal risk management standards. Their finding shows that project success rate was higher in organisations that employ risk management than those that do not (Wet & Visser 2013:26).

It was observed that despite the several studies that have been carried out on software project risk management such as frameworks on risk management strategies, processes, factors, the impact on project success or failure (e.g. Alhawari et al. 2012; Barros, Werner & Travassos 2004; Bakker, Boonstra & Wortmann 2010; Bhatia & Kapor 2011; Teller & Kock 2013; Ward & Chapman 2003), much is not said about risk management practice in software projects. The situation is worse in Ethiopia. To the knowledge of the investigator, there is no publication on risk management practice in Ethiopian software project management. All attempts to look up research work on risk management practice in Ethiopia in databases that offer a wide range of journal articles, such as ACM, Emeraldinsight, JSTOR and ScienceDirect, ended with no results.

The Standish Group report indicates that the success rate of American software projects amounts to only 16.2% (Standish 2014:4). Despite the fact that it was not possible to obtain publications on the Ethiopian software project success rates, the investigator had unfortunate chances of witnessing software projects failing either before completion and delivery or after implementation. This has raised the question, “What is the risk management practice in Ethiopia?” and, “Could the rate of project failure be related to risks and risk management?”

1.2 PURPOSE OF THE RESEARCH

The purpose of this research is to investigate the practice of risk management in Ethiopian projects and subsequently examine whether this practice affects software project success. It examines whether formal risk management procedures are included in the project management process. The study also assesses if the projects under study include risk identification, mitigation or response, and monitoring and control

mechanisms. It also identifies the major risk factors in the Ethiopian software projects. Finally, the study evaluates if application of formal methods and risk management practice affect project success.

1.3 PROBLEM STATEMENT

According to The Federal Democratic Republic of Ethiopia Ministry of Communication and Information Technology, Information and Communication Technology is one of the strategic priorities in the country. In lieu of the country's stride for substantial growth, the Government of Ethiopia highly encourages and promotes the use of information and communication technology in all development sectors (Ethiopia, Ministry of Communication and Information Technology 2009:1). In view of this, many Information System projects are being implemented both in for profit and non-profit organisations in the country. However, information and communication technology is a relatively new concept in Ethiopia and projects may face different challenges in their implementation. Software projects are no exception as risk is one of the factors affecting software projects. Risk can damage projects if it is not managed well. The literature suggests that the effect of risks can, however, be controlled by putting effective risk management procedures in place (Bannerman 2008:2119; Bhatia & Kapoor 2011:1; López & Salmeron 2012b:438; Royer 2000:6).

Though the researcher was not able to find a publication on the success and failure rate of Ethiopian software projects, as a software developer and former employee of a software vendor, the investigator had witnessed several projects failing either before completion and delivery or after. There was neither a publication on the risk management practice nor one that shows the impact of risks on project success in the Ethiopian context.

This research investigates whether risk management is included in the project management process of Ethiopian software projects. It examines if formal risk management standards are applied and also identifies which steps of risk management

procedures are included in the informal risk management processes. Further, it identifies major risk factors the Ethiopian software projects are facing.

Organisations can practice risk management by applying available formal models or they could define their own ad-hoc risk management process by conducting the risk management steps as it fits in their project management. This research explores the impact of employment of formal risk management techniques on success of projects. With this, the study looks into success rate of projects employing formal risk management models compared to those which do not, even if they may practice ad-hoc risk management. Finally, the study investigates the relationship between success rate of projects in organisations practicing either formal or ad-hoc risk management compared to those which do not practice any form of risk management at all.

1.4 RESEARCH QUESTIONS

Thus the research questions of this study are:

- *Are formal risk management procedures applied in Ethiopian software projects?*
- *Is risk management practiced in Ethiopian software projects?*
- *Are all the risk identification, analysis, mitigation or response, and monitoring and control steps included in the risk management process?*
- *What are the top ten risk factors encountered by Ethiopian software projects?*
- *Is the success of Ethiopian software projects affected by the application of formal risk management standards?*
- *Is the success of Ethiopian software projects affected by the risk management practice?*

1.5 RESEARCH STRATEGY

Research strategy is defined as the overall approach to answering the research questions or testing the hypothesis that stimulated the research (Oates, 2006:35). Information gathering on the risk management practices in software project management was done by collecting and analysing data from a range of software projects that have been implemented in banks, insurance companies and United Nations (UN) agencies in Addis Ababa, Ethiopia. This research employed quantitative research approach. The Google Forms online survey tool was used to collect data with questionnaire data collection method.

1.6 SAMPLING

This research has used non-probabilistic purposive sampling. Non-probabilistic sampling is used when it is not feasible or necessary to have representative sampling. Conclusions drawn from non-probabilistic sampling will not be generalized to the total population, but limited to the population under study based on the observed pattern (Oates 2006:98; Tongco 2007:154).

Purposive sampling can produce reliable and robust data. The informants of a purposive sampling are those who are knowledgeable and willing to share information. On the other hand, purposive sampling can be subjected to bias as selection of informants can be done based on convenience or recommendation of knowledgeable people Tongco (2007:147, 153-154). By assessing the risk management practice and its probable effect on the success or failure of projects, this study explored sensitive organisational information. Hence the investigator believes that approaching a specific and limited number of informants who are willing to share their knowledge and information can result in better response rate and reliable data than sending out questionnaires to a random sample of the population. Besides, software risk management practice can only be studied in organisations which have undertaken

software project. The target population of this study are therefore organisations which are known or are likely to have carried out software projects. The investigator is an employee of one of the United Nations Agencies in Addis Ababa, Ethiopia, and had the opportunity to interact with a few other agencies, which has also helped to observe the existence of information systems in the agencies. On the other hand, the law of the Federal Republic of Ethiopia obliges banks and insurance companies to establish an information system to get License (Ethiopia, House of Peoples' Representatives 2008:4207; Ethiopia, House of Peoples' Representatives 2012:6472). For the above reasons, the study population of this study consisted of UN agencies, banks and insurance companies in Addis Ababa, Ethiopia.

1.7 DATA COLLECTION AND ANALYSIS

This study used questionnaires through an online survey for data collection. Participants were invited through email invitation and telephone calls. The objective of the study, and the scope, was explained to participants. Studies show that online survey allows wide reach without going through the trouble of travelling or using other slower means. It provides respondents with the possibility of participating at their convenient time. Moreover, online survey applications have the advantage of obtaining flexibility in displaying questions using form controls like option buttons, check boxes, and drop down lists. These controls maintain ease and convenience of users in selecting choices. Using such controls contributes to ensuring accuracy of collected data. The survey data will also be readily available in digital form that saves time by avoiding data encoding (Evans & Mathur 2005:199; Wright 2005).

Several online survey applications are available on the web. This study was conducted on banks, insurance companies and UN agencies, which have very secured IT environments. Such organisations have a huge concern about the security of applications they access and they do not allow access to all kinds of software and online applications. For this reason, the well-known Google application was used to

collect data through the course of this study. Use of Google forms was comfortably accepted by participants as many of the organisations do not block Google applications in their network.

However, online survey is criticized for securing less response than email survey and even less than postal mails (Evans & Mathur 2005:201; Fricker & Schonlau 2002:6; Wright 2005). Continuous follow up was done to maximize participation through email and phone calls.

1.8 ETHICAL CONSIDERATIONS

This research has strived to meet the expected ethical obligations by maintaining the rights of participants. The researcher obtained ethical clearance from the University of South Africa Ethical Clearance Board, thereby committing to adhere to the university's ethics policy. Respondents were clearly informed that participation is voluntary and in no way forced. They were notified that if they decided not to participate in the research, their decisions would be respected and they would in no way be obligated to take part.

Likewise, it was clearly stated in the questionnaire that participants reserved the right to change their minds after they gave their first consent to take part or even after they started participating in the study, and that their right to withdraw anytime would be well respected. Due attention was given in this study to participants' right to get full information about the purpose of the research and the ethical grounds considered in the research. Adequate information was given to participants about the objectives of the research. They were additionally made aware of their right to access the final findings if they were interested. They were encouraged to give their consent to participate by fully understanding and agreeing to the information provided.

Participants have the right of having their identity and location be protected. Care was taken in this regard by using a secured online survey system. The survey was

anonymous and the participant and organisation identity fields in the questionnaire were made optional in respect of respondents' right of anonymity.

One of the participant-related ethical obligations in a research is keeping the confidentiality of data obtained from respondents. Data was collected using the reliable and secured data collection tool, Google Forms. No printed data was left to be easily accessed partially or in full by intruders or unsolicited persons.

1.9 VALIDITY AND RELIABILITY

1.9.1 VALIDITY

Purposive sampling does not intend to generalize the drawn conclusion; rather it emphasizes on gathering and analysing quality data from willing and capable informants. It provides reliable and robust data and contributes to internal validity but does not guarantee external validity (Tongco 2007:154). Measures taken to improve internal validity in this study include due attention to careful selection of appropriate respondents in order to acquire the right information from the right person and ensuring anonymity to enable research subjects to provide honest responses (Oates 2006:288).

1.9.2 RELIABILITY

In developing the research instrument, due attention was given to avoiding leading questions. Questions were designed in such a way that they were understood by respondents in the same way in order to increase reliability of the study. The research instrument was reviewed by colleagues and persons with statistics and risk management background and comments were incorporated. Pre- and pilot-testing were conducted to improve reliability of the instrument (Oates, 2006:287; Tongco, 2007:155).

1.10 SCOPE OF THE STUDY

The research was carried out on 45 banks, insurance companies and UN agency offices in Addis Ababa, Ethiopia. The research does not anticipate generalizing the finding to a larger population. The research participants were software project managers and the study does not include views of other stakeholders such as end users, vendors and donors.

1.11 SIGNIFICANCE OF THE STUDY

The investigator believes that this study will contribute to the body of knowledge in the context of Ethiopian software projects. The research participants could benefit from this study as they will have a chance to see a compiled view of the practice of risk management, build up on their successes and work on issues that may need improvement. The findings could also serve as baseline information for future research. Additionally, the study presents researchers with areas for further studies like factors influencing the level of risk management practice in the Ethiopian software project management. The research was carried out on financial sectors (banks and insurance companies) and UN organisations. These organisations invest heavily on Information Systems and mobilize huge resources to software projects. Thus, though the research does not aim to generalize the finding to a larger population, it is hoped that the result can give an insight on the research topic in the Ethiopian context.

1.12 LIMITATION OF THE STUDY

The study adopted purposive non-probabilistic sampling and the study population was composed of banks, insurance companies and UN agencies in Addis Ababa, Ethiopia. Though these are organisations that invest heavily on information systems, and the

research is believed to give an insight on the subject in the Ethiopian context, the findings cannot be generalized to reflect the reality in other business areas like smaller private sector and government offices. Moreover, the scope of the study was limited to only assessing whether risk management was included in the project management process or not, and did not look into details of the factors influencing the level of risk management practice.

1.13 RESEARCH OUTLINE

This research is organized into eight parts and outlined as below:

Abstract provides the summary of the research and keywords pertaining to the study.

Chapter 1 (The Study): provides introduction to the study and highlights the orientation of the paper.

Chapter 2 (Literature Review): discusses the literature reviewed and findings from the literature.

Chapter 3 (Research Methodology): provides details of research design, procedure of sampling, data collection method and process, measures taken to improve the trustworthiness of the research by maintaining validity and reliability.

Chapter 4 (Discussion and Analysis of the Research Findings): presents research findings with the methods and procedures that were employed in data analysis.

Chapter 5 (Conclusion and Recommendations): draws conclusions based on the research findings and interpretation vis-a-vis the research objectives and makes recommendations. It also discusses the contribution of the study and its limitations.

References: references of sources used in this study are listed here.

Appendices: contains copy of ethical clearance obtained from UNISA and copy of the research instrument.

1.14 SUMMARY

This chapter highlighted the research problem; the purpose and objectives of the research; the research strategy and methodology employed; the sampling and data collection methods; ethical and legal considerations; validity and reliability; the significance and limitation of the research; and the structure of the dissertation.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Effective literature review yields a solid theoretical foundation to better understand and explain the study topic, problems and solutions. It enables the researcher to discover existing knowledge. Through a detailed exploration, researchers can expand their knowledge on the topic and identify where further research is needed. Discovering the gaps enables investigators to demonstrate the contribution of the proposed research to the body of knowledge. By exploring similar studies, researchers can learn the most appropriate research approaches that could result in the best result to their investigation. This helps them in the selection of research methodology (Levy & Ellis 2006:183-184; Webster & Watson 2002:xiii).

Literature review is conducted at different stages of a research. Researchers study existing knowledge prior to embarking on the research to acquire sound technical background. At this stage, they identify gaps and discover opportunities for further research. The literature is studied throughout the research process to support the research case with sound evidence and also to keep up with new findings (Levy & Ellis 2006:183-184; Webster & Watson 2002:xiv). Without a literature review, it is impossible for the researcher to understand the topic, what has already been done, how it has been researched, what the key issues are, and what else could be studied (Hart 1998:1).

In this study, a preliminary literature review was conducted at the proposal development stage to gather knowledge on the research area. That has also helped to formulate the research question and to develop a feasible research methodology. Further, detailed review was done until completion of the research in order to expand the investigator's understanding throughout data collection, analysis and reporting stages.

This chapter discusses the knowledge acquired through review of literature on the research topic. It describes the source and theme of publications studied. It defines risk and risk management as indicated in the literature and highlights a few of the well-known risk management process models. Analysis of top ten risk factors ranked by project managers from different countries, as most occurring in software projects, is presented in this section. Risk management practices from surveys conducted in Australia, Nigeria, South Africa and 13 countries across four continents are reviewed. The hypotheses formulated based on the literature study are also presented in this chapter.

2.2 LITERATURE SOURCES AND THEMES

A wide range of resources, including journals, conference and workshop proceedings, books, reports, website articles and other online resources were reviewed to get an in-depth understanding of risk, risk management, risk management approaches, risk management practices, most frequently occurring software risks, and relationship between application of formal risk management and project success, and the relationship between risk management practice and project success. Similarly, resources were studied to determine the research methodology and approach to be used in this study. Dissertations of the same kind were reviewed to help develop the structure of this study. Most of the resources were accessed through the UNISA Online Library and e-journal database.

2.3 RISK

Risk is expressed as an event or condition that can arise at any phase of a project and can affect the project's expected outcome such as delivery time, budget or quality if not handled well. Risks can threaten the success of projects, and as a result, can prohibit organisations from realizing their goals, ambitions and plans (Alhawari et al. 2012:51;

Bakker et al. 2010:496; Bhatia & Kapoor 2011:1; Boehm 1991:33). Mnkandla (2012:281) describes risk as "the potential for loss, damage or destruction of a system as a result of a threat exploiting vulnerability."

Other researchers do not agree with the above definition which stresses the adverse effect of risks. They argue that the negative impact of risks is over-emphasized, because, although they can potentially cause damage, if managed well, risks can also bring about opportunities of positive impacts (Sanchez et al. 2009:16; Ward & Chapman 2003:98; Zhang 2007:694). Authors underscore that the focus of risk management should not only emphasize the unfavourable impact of risks, restricting the opportunities threats may present to projects (Ward & Chapman 2003:98). These arguments comply with the similar definitions of risk by the US Project Management Institute (PMI) and the United Kingdom Association for Project Management (APM).

The Project Management Body of Knowledge (PMBOK) defines risk as "an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality" (PMI 2013:310).

There is a general agreement on describing risk by two attributes: its possibility or likelihood of occurrence and the magnitude or severity of impact it brings if it occurs. This is symbolically represented as

$$R = P \times I$$

where R is the exposure to a particular risk factor, P is the probability or likelihood of occurrence and I is the magnitude of its consequence or impact (Alhawari et al. 2012:51; Boehm 1991:33; Bannerman 2008:2119; Dareshuri, Darehshori, Hardoroudi & Sarkan 2011:328; Han & Huang 2007:42; Keil, Li, Mathiassen & Zheng 2008:909; López & Salmeron 2012b:441).

2.4 RISK MANAGEMENT

If not managed well, risks can cause serious damage or failure to projects. According to the PMBOK, they can also be opportunities for positive effect. Risks should be managed well in order to control their adverse effects and also to make the best of the probable positive outcomes they can produce. Failure to manage risks may result in severe consequence on projects and may even cause total failure. Also, the positive impact that can arise from risks can be missed if proper risk management is not in place. (Sanchez et al. 2009:16; Ward & Chapman 2003:98). Due to their complex nature, software projects may face many challenges and can easily be exposed to risks that can affect their success. Risk management helps project managers to control and prevent unprecedented project outcome (Fakhar, Abbas & Waris 2013:223; Roy 2004:1; Sarigiannidis & Chatzoglou 2014: 1073-1074; Tesch et al. 2007:62).

Risk management defines the strategies, tools and methods to identify and control or manage risks. Its objective is to minimize the probability and impact of potential risks while maximizing the probability and impact of potential opportunities, and thus keeping the outcome of the project under the control of Management (Roy 2004:1; Tesch, et al. 2007:62). It involves identifying all applicable risks to a project, ranking them based on their probability of occurrence and magnitude of impact, and devising controlling mechanisms (Alhawari et al. 2012:51; Bannerman 2008:2120; Marcelino-Sádaba et al. 2014:329). Bannerman (2008:2127) argues that risk management is more than a process and methodology of identifying risks, assessing risks and putting mitigation and controlling mechanisms in place, but is “a real-time threat management capability that is developed within an organisation, through learning, practice, and other mechanisms, over a long period of time.” As risks may arise at any phase of a project, risk management should be incorporated in all phases of project management, from definition of the project through its planning, execution and up to its completion and closure (Raz & Michael 2001:9).

2.5 FORMAL RISK MANAGEMENT MODELS

Numerous well known risk management standards are available that can be adopted and implemented at project as well as organisational levels. Formal risk management models follow well defined procedures that allow identifying, managing and controlling risks. A few of the well-known risk management standards include Boehm's Risk management model, the Capability Maturity Model Integration (CMMI), the PMBOK risk management Process, the IEEE risk management process model, and Kontio's Riskit risk management framework.

Boehm's risk management model categorizes the risk management process into two major phases: risk assessment and risk control. The risk assessment phase comprises of risk identification, analysis and prioritization steps, and the risk control phase consists of risk monitoring planning, resolution and monitoring steps (Boehm 1991:34-39).

Developed by the Software Engineering Institute (SEI), the Capability Maturity Model Integration (CMMI) risk management technique constitutes of three major parts: preparing for risk management, identifying and analysing risks, and mitigate risks. (SEI, 2010:349).

The PMBOK Risk Management Process includes seven major steps: risk management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, risk monitoring and control. Risk analysis is done in two phases in this model. Qualitative risk analysis prioritizes risks based on the possibility of their occurrence and the degree of their impact if they occur. The quantitative risk analysis examines the probability of achieving cost and time objectives vis-à-vis the effect and probability of risks (PMI, 2013:312-354).

The IEEE Risk Management Process Model consists of six cyclic activities that take place throughout the project life cycle described as plan and implement risk management, manage the project risk profile, perform risk analysis, perform risk monitoring, perform risk treatment, and evaluate the risk management process (IEEE, 2001:5-13).

Kontio's Riskit model contains seven cyclic steps that help minimize adverse effects of risk and maximize potential opportunities. It helps project management and stakeholders to acquire timely and accurate information on risks and opportunities in the project. The model includes risk management mandate definition, goal review, risk identification, risk analysis, risk control planning, risk monitoring and risk control steps (Kontio, 2001:55).

Though the details of phases may differ, most of the formal procedures contain the common risk identification, analysis, mitigation or response, and monitoring and control steps. Even though organisations may not adopt a documented formal technique, they could practice risk management in their project implementation by performing the risk management steps as they fit the organisation's need and context (Bannerman 2008:2124; Wet & Visser 2013:26).

Several other risk management process frameworks have been proposed. Alhawari et al. (2012:54-63) propose a Knowledge-Based Risk Management Framework that also employs knowledge management processes. Fairley (1994:58-66) suggests a step-by-step guide for risk management to help project managers clearly understand the processes. Marcelino-Sádaba et al. (2014:329-335) propose a risk management methodology that can be employed in small firms where projects are not managed by skilled project management professionals. Roy (2004) provides a ProRisk Management Framework that focuses on the business and operational domain of software projects. Wang, Jia and Qu (2010:2000-2002) propose an Earth-Moon framework that integrates risk management into the lifecycle of software project.

Despite the availability of well-defined and documented standards, gaps are observed in the application of formal risk management models in software projects. In a survey of risk management practice conducted on 17 projects in Australia, Bannerman (2008:2124-2125) found out that a majority of the projects did not apply formal risk management procedures. Only 29% of the projects he studied applied documented risk management standards while the rest did not make use of a complete model. This is, however, different from the assessment on 37 organisations over 13 countries across

Asia, Europe and Americas, which showed a higher level of application of formal risk management standards. The study evaluated the compliance of risk management processes in organisations that were already identified to have practiced risk management. In this study, 91% of the respondents utilized a defined risk management process while the remaining 4 did not have documented model (Kajko-Mattsson & Nyfjord 2008).

On the other hand, more studies are available that demonstrate low practice of formal methods. A study in South African software projects yielded a very low result. Of 35 South African software projects studied, only one indicated that they use a standard risk management procedure (Wet & Visser 2013:23-26). Another investigation of risk management practices in Africa, conducted on outsourcing of information system projects in Nigerian commercial banks, showed that none of the banks under study used standard risk management procedures or guidelines (Adeleye, Annansingh & Nunes 2004:176). The above studies reveal the gap in application of formal risk management standards. Moreover, the two studies may also be indications of minimal practice of formal risk management in Africa. The following hypotheses can thus be suggested:

H01: Formal risk management procedures are not applied in the Ethiopian software projects.

H11: Formal risk management procedures are applied in the Ethiopian software projects.

2.6 RISK MANAGEMENT PRACTICE

The importance of risk management has been recognized and well presented in the literature. It is one of the ten knowledge areas in the PMBOK (PMI 2013:60-61) and also one of the CMMI process areas (Software Engineering Institute 2010:11). Several authors have discussed research management, and numerous studies are still being

conducted. However, despite its importance and the continued attention by academia, studies show that risk management practice is still inadequate (Baloch, Qadri, Hassain, Ahmad, Siddique & Azam 2014:1525; Hartono, Sulistyo, Praftiwi & Hasmoro 2014:407; Hu, Zhang, Ngai, Cai & Liu 2013:439; Khan, Qadri, Ahmad, Siddique, Ayoub & Saeed 2014:120; Mnkandla, 2012:279; Silva, Trigo & Varajão 2012:158; Wet & Visser, 2013:26) and that projects are suffering from inadequate control of risks (López & Salmeron 2012a , Tianyin 2011:2980).

Several reasons are cited for leaving out risk management from the whole project management process. Risk management is one of the least frequently practiced components because unlike time, schedule and cost of projects, it is an area difficult to measure. Project managers are likely to give higher attention to components whose effect can easily be observed and measured, such as time, schedule and cost than risks. Another factor which inhibits the risk management practice is project managers' tendency to prefer to focus more on the project outcome than on matters that could go wrong (Papke-Shields, Beise & Quan 2010:654-659). Management misunderstanding as well greatly contributes to the low priority given to risk management exercise in project management. Risk management is sometimes considered by organisation management as an extra work and cost, and the control that it puts on projects is regarded as inhibiting creativity (Kwak & Stoddard 2004; Papke-Shields et al. 2010:654-659, Tianyin 2011:2980). Denying, avoiding thinking about what could go wrong, and shielding themselves from the responsibility that comes together with risks are some of the characteristics observed on project managers (Papke-Shields et al. 2010:654-659; Royer 2000). In some organisations the magnitude of project in terms of project budget, schedule and degree of product innovation acts as a decisive factor for employing risk management in the project. Only 21 out of 37 companies in Kajko-Mattsson and Nyfjord (2008) implemented risk management in all software projects, while the decision to carry out risk management in the rest 16 companies depended on project magnitude or other factors.

Bannerman (2008:2124-2125) found that a considerable amount of projects did not include risk management procedures in their project management. The study finding

shows that 29% of the projects under study conformed formal risk management procedures, 41% adopted semi-formal or informal procedures and the remaining 29% did not practice risk management at all. The finding shows that 15 out of 17 projects encountered unanticipated problems during the project life time (Bannerman 2008:2124-2125).

The research conducted on South African projects shows that a majority of the projects (60%) did not include risk management procedures in their project management. The study concludes that the software project risk management cannot be considered adequate and recommends South African software projects to adopt risk management approaches in their project management in order to improve their delivery as planned (Wet & Visser, 2013:23-26).

In a recent research conducted on software projects in China, Tianyin (2011:2980) observed that the risk management process in China is not yet systematic and the software projects are still in learning phase of theories and methodologies. According to Tianyin (2011:2980), recognition of risk is considered as defeatism and project managers exhibit a trend of avoiding talking about risk management and as a result fail to control and manage avoidable risks, often leading to failure.

The studies show a low practice of risk management in software projects. Information technology being a relatively new concept in Ethiopia, it is expected that the situation will not be much different from the above studies. Therefore, we can establish the following hypotheses:

H02: Risk management procedures are not exercised in the Ethiopian software projects.

H12: Risk management procedures are exercised in the Ethiopian software projects.

2.7 STEPS INCLUDED IN RISK MANAGEMENT PRACTICE

Another important issue to consider in the study of risk management is which steps of the risk management process project managers carry out. While completely leaving risk management out of the project management process is typical, failing to implement all phases of the process is also common.

A number of studies have shown that projects undertake some steps of the process and omit the rest. The study on Nigerian commercial banks shows that not all projects that identified their risks proceeded with preparation of response and monitoring plans. In the study, 48.5% of the projects carried out risk identification on outsourcing of information system projects. But only 42.8% examined the impacts of risks and also developed departmental mitigation and response plans to avoid the risk occurrence and minimize the impact (Adeleye et al. 2004:176-177).

A similar situation is observed in the South African study. Only 40% of 35 software projects followed one or more of the steps identified by the IEEE Standard for Software Risk Management. The study, though, does not indicate details of which of the identified steps the projects followed and which ones they missed out (Wet & Visser 2013:23-26). Likewise, of the 37 projects included in the Kajko-Mattsson and Nyfjord (2008) study, 34 identified the risks, 33 carried out both risk identification and risk analysis, 22 companies included risk management planning phase and 24 proceeded further with risk monitoring and control (Kajko-Mattsson & Nyfjord, 2008). We can thus suggest the following hypotheses:

H03: Organisations undertaking risk management do not include all the identification, analysis, mitigation, response, monitoring and control steps

H13: Organisations undertaking risk management include all the identification, analysis, mitigation, response, monitoring and control steps

2.8 RISK FACTORS

2.8.1 RISK CATEGORIZATION

Software projects are complicated with multiple phases, stakeholders and interest groups that increase their potential of being affected by risks. Therefore, many software projects are faced with multiple risks (Dareshuri et al. 2011: Keshlaf & Riddle 2010:22; Tianyin 2011:2979; Wang et al. 2010:1999).

Based on a survey on experienced project managers, Boehm (1991:35) presents a checklist that comprises 10 top project risk sources: personal shortfalls, unrealistic time and cost estimates, developing the wrong software functions, developing the wrong user interface, gold plating, late changes to requirements, shortfalls in externally supplied components, shortfalls in externally performed tasks, real time performance shortfalls, straining computer science capabilities.

Barki, Rivard and Talbot (1993:205-213) argue that the attributes that define software risk should be uncertainty and magnitude of loss rather than probability and magnitude of loss. They argue that risk factors are the same as uncertainty factors. Based on this definition, the paper groups the risk factors identified from their survey of 120 projects into 17 categories which were further grouped into five risk dimensions: novelty of project, size of application, lack of expertise, application complexity, and organisational environment.

Tesch et al. (2007:62-66) conducted a survey of project management professionals' perspective on 92 IT project risk factors. The survey categorizes the 92 risk factors into six groups as sponsorship ownership, funding and scheduling, personnel and staffing, scope, requirements, and relationship management.

An empirical research on the literature on factors influencing the outcome of software projects by McLeod and MacDonell (2011:3-41) comes up with a new classificatory framework consisting of 18 risk factors classified into 4 major categories as project content, development process, institutional context, and people and action. The project

content category includes the risk factors: developers, users, top management, external agents, project teams, and social interaction. Requirements determination, project management, use of a standard method, user participation, user training, and management of change are grouped as development process category. The project content category includes project characteristics, project scope, goals and objectives, resources, and technology risk factors. The institutional context category comprises of organisational properties and environmental conditions.

Wallace, Keil and Rai (2004:116-118) built up on the risk management dimensions in the literature and incorporated practitioners' input. Following an extensive literature review and several interviews with project management practitioners, they categorized risk factors into six dimensions: team, organisational environment, requirements, planning and control, user, and project complexity.

The Wallace et al. (2004) risk categorization has been adopted by several research (Arnuphaptrairong 2011; Han & Huang 2007; Nakatsu & Iacovou 2009:57; Sarigiannidis & Chatzoglou 2014). This dissertation also adopts the same Wallace et al. (2004:116) risk dimensions and factors. It was chosen mainly because the categorization and presentation of risk factors were found to be convenient to incorporate in the research instrument in the form of question. The research instrument presented the Wallace et al. risk factors in Likert scale format asking participants to provide their opinion on the level of the occurrence of the risk items in the projects. A few rearrangements were done in the order of the risk items in order to maintain the flow of questions. All risk items were presented as Likert items in a positive connotation sentence format.

Table 2.1 below shows the Wallace et al. risk categorization.

TABLE 2.1: THE SIX DIMENSIONS OF SOFTWARE PROJECT RISK

RISK CATEGORIZATION	RISK FACTORS
Team (T)	- Frequent conflicts between development team members - Frequent turnover within the project team - Team members not familiar with the task(s) being automated - Team members lack specialized skills required by the project - Inadequately trained development team members - Lack of commitment to the project among development team members - Inexperienced team members
Organisational environment (OE)	- Lack of top management support for the project - Change in organisational management during the project - Organisation undergoing restructuring during the project - Unstable organisational environment - Corporate politics with negative effect on project - Resources shifted away from the project because of changes in organisational priorities
System Requirements (SR)	- Incorrect system requirements - Users lack understanding of system capabilities and limitations - Undefined project success criteria - Conflicting system requirements - Difficulty in defining the inputs and outputs of the system - Unclear system requirements - System requirements not adequately identified - Continually changing system requirements
Planning and control (P&C)	- Project milestones not clearly defined - Project progress not monitored closely enough - Lack of an effective project management methodology - Inexperienced project manager - Poor project planning - Lack of ‘‘people skills’’ in project leadership - Ineffective communication - Inadequate estimation of required resources - Inadequate estimation of project schedule
User (U)	- Lack of cooperation from users - Users resistant to change - Users not committed to the project - Lack of user participation - Conflict between users - Users with negative attitudes toward the project

Technical Complexity (TC)	- Project involves use of technology that has not been used in prior projects - Large number of links to other systems required - High level of technical complexity - One of the largest projects attempted by the organisation - Project involved the use of new technology - Many external suppliers involved in the development project - Immature technology - Highly complex task being automated

(Wallace et al., 2004:122-123)

2.8.2 TOP TEN RISK FACTORS AFFECTING PROJECTS

Research has suggested a list of the top ten risk factors affecting software projects. The studies show that the dimensions and types of the most important risks on software projects vary according to different contextual factors. This section presents an analysis of surveys of the top ten risks conducted on South African, Nigerian, Canadian, Hongkonger, Finish and American project managers.

A study conducted in South Africa on 36 project managers in the IT and finance sectors, identified the top ten risk factors comprising five risk dimensions (Addison & Vallabh, 2002:134). The list consisted of four system request, three planning and control, one user, one organisational environment and one team risks. Table 2.2 shows the top ten ranked risks in the study. A majority (seven out of 10) of the top risks identified in this study were associated with system requirement and project planning and control. No risk in the technical complexity dimension was found to be in the list of top ten risks in this study.

A Delphi study carried out in Nigeria in 2003 (Mursu, Lyytinen, Soriyan & Korpela 2003:186) identified three system request, three planning and control, two team, one technical complexity, and one organisational environment risks. Similar to the South African finding, a majority (six out of 10) of the risks identified were associated with system requirement and project planning and control. User-related risks were not among the ten most common risks in the Nigerian study.

TABLE 2.2: TOP TEN RISKS IN SOUTH AFRICA

RANK	RISK	DIMENSION
1	Unclear or misunderstood scope/objectives	SR
2	Misunderstanding the requirements	SR
3	Failure to gain user involvement	U
4	Lack of senior management commitment	OE
5	Developing the wrong software functions	SR
6	Unrealistic schedules and budgets	P&C
7	Continuous requirement changes	SR
8	Inadequate knowledge/skills	T
9	Lack of effective project management methodology	P&C
10	Gold plating	P&C

(Addison & Vallabh 2002:134)

TABLE 2.3: TOP TEN RISKS IN NIGERIA

RANK	RISK	DIMENSION
1	Misunderstanding the user requirements	SR
2	Lack of effective development process/methodology	P&C
3	Lack of required knowledge/skills in the project personnel	T
4	Lack of skilled personnel	T
5	Under funding of development	P&C
6	Import of foreign packages	TC
7	Lack of 'people skills' in project leadership	P&C
8	Unclear/misunderstood scope/objectives	SR
9	Changing scope/objectives	SR
10	Energy supply	OE

(Mursu et al. 2003:186)

An assessment of the top ten most important risks in clinical information systems in Canada resulted in a list composed of five dimensions. The Delphi survey, conducted on 21 experts, generated a list of highly ranked risks consisting of three organisational environment, two planning and control, two user, two team, and one system request risks (Paré, Sicotte, Jaana & Girouard 2008:7). Like the South African study, no technical complexity risk was identified among the top ten risks. However, the finding of this study is different from that of the South African and Nigerian observations in that only three out of 10 risks were associated with system requirement and project planning and control. Rather, the risks seem to be evenly distributed over the five dimensions.

Schmidt, Lyytinen, Keil and Cule (2001:21-22), conducted an international Delphi study to evaluate the top ten important risks in Hong Kong, Finland and the USA. The composite ranks of the three panellists resulted in a list comprising of four user, three system requirement, two team, one organisational environment, and one technical complexity risks. This shows that the majority of the most recurring ten risks in the three countries stem more from user commitment and involvement than project specification, planning and control unlike the most important risks in South African and Nigerian software projects.

TABLE 2.4: TOP TEN RISKS IN CANADA

RANK	RISK	DIMENSION
1	Lack of project champion	U
2	Lack of commitment from upper management	OE
3	Poor perceived system usefulness	U
4	Project ambiguity	SR
5	Misalignment of system with local practices and processes	P&C
6	Political games/conflicts	OE
7	Lack of required knowledge skills	T
8	Changes to membership on the project team	T
9	Organisational instability	OE
10	Insufficient resources	P&C

(Paré et al. 2008:7)

In general, the three panels ranked lack of top management commitment as the most important risk item. When we look at the individual rankings of the three countries, the Hong Kong panel ranked five user risks out of 10. On the contrary, the Finland panellists included only one user risk in their list of most important risks. The most common dimension in the Finland case was planning and control (five risks among the top 10). The top ten risks identified by the USA panel were evenly distributed in the user, planning and control, and system requirement dimensions (three in each dimension).

TABLE 2.5: TOP TEN RISKS IN HONG KONG

RANK	RISK	DIMENSION
1	Lack of top management commitment	OE
2	Lack of adequate user involvement	U
3	Failure to gain user commitment	U
4	Lack of cooperation from users	U
5	Changing scope/objectives	SR
6	Change in ownership or senior management	OE
7	Misunderstanding the requirements	SR
8	Lack of frozen requirements	SR
9	Failure to manage end user expectations	U
10	Conflict between user departments	U

(Schmidt et al. 2001:21)

TABLE 2.6: TOP TEN RISKS IN FINLAND

RANK	RISK	DIMENSION
1	Lack of effective project management skills	P&C
2	Lack of top management commitment	OE
3	Lack of required knowledge skills in the project personnel	T
4	Not managing change properly	P&C
5	No planning or inadequate planning	P&C
6	Misunderstanding the requirements	SR
7	Artificial deadlines	P&C
8	Failure to gain user commitment	U
9	Lack of frozen requirements	SR
10	Lack of “people skills” in project leadership	P&C

(Schmidt et al. 2001:21)

TABLE 2.7: TOP TEN RISKS IN USA

RANK	RISK	DIMENSION
1	Lack of top management commitment	OE
2	Misunderstanding the requirements	SR
3	Not managing change properly	P&C
4	Failure to gain user commitment	U
5	Lack of effective project management skills	P&C
6	Lack of adequate user involvement	U
7	Failure to manage end user expectations	U
8	Lack of effective project management methodology	P&C
9	Unclear/misunderstood scope/objectives	SR
10	Changing scope/objectives	SR

(Schmidt et al. 2001:21)

The majority of the risk items mentioned in the top ten risks fall under the system requirement (16 out of 60) and planning and control (16 out of 60). User risks also affect projects in an almost similar proportion while organisational environment and team risks occur in projects to a non-significant degree. Technical complexity risks are almost non-existent in software projects.

TABLE 2.8: FREQUENCY OF TOP TEN SOFTWARE RISKS BY DIMENSION

RISK DIMENSION	NUMBER OF OCCURRENCES
System requirement	16
Project planning and control	16
User	12
Organisational environment	9
Team	6
Technical complexity	1
Total	**60**

The top two most mentioned risk items among the six surveys were 'lack of senior management commitment' and 'misunderstanding the requirements'. Both were mentioned by five out of 6 studies. 'Inadequate knowledge/skill' was mentioned four times. 'Unclear, misunderstood and changing scope/objectives' and 'lack of effective project management methodology' ranked third in the most frequent top risks. All except these six risk items appeared once or twice.

Table 2.9 below presents frequency of top ten software risks.

TABLE 2.9: FREQUENCY OF TOP TEN SOFTWARE RISKS

No.	RISK ITEM	DIME-NSION	RANK						FREQ
			SOUTH AFRICA	NIGERIA	CANADA	HONG KONG	FINLAND	USA	
1	Lack of senior management commitment	OE	4		2	1	2	1	5
2	Misunderstanding the requirements	SR	2	1		7	6	2	5
3	Inadequate knowledge/skills	T	8	3	7		3		4
4	Unclear or misunderstood scope/objectives	SR	1	8				9	3
5	Lack of effective project management methodology	P&C	9	2				8	3
6	Changing scope/objectives	SR		9		5		10	3
7	Failure to gain user involvement	U	3					4	2
8	Lack of 'people skills' in project leadership	P&C		7			10		2
9	Lack of adequate user involvement	U				2		6	2
10	Failure to gain user commitment	U				3	8		2
11	Lack of frozen requirements	SR				8	9		2
12	Failure to manage end user expectations	U				9		7	2
13	Not managing change properly	P&C					4	3	2
14	Lack of effective project management skills	P&C					1	5	2
15	Unrealistic schedules and budgets	P&C	6				7		2
16	Developing the wrong software functions	SR	5						1
17	Continuous requirement changes	SR	7						1
18	Gold plating	P&C	10						1
19	Lack of skilled personnel	T		4					1
20	Under funding of development	P&C		5					1
21	Import of foreign packages	TC		6					1
22	Energy supply	OE		10					1
23	Lack of project champion	U			1				1
24	Poor perceived system usefulness	U			3				1
25	Project ambiguity	SR			4				1
26	Misalignment of system with local practices and processes	P&C			5				1
27	Political games/conflicts	OE			6				1
28	Changes to membership on the project team	T			8				1
29	Organisational instability	OE			9				1
30	Insufficient resources	P&C			10				1
31	Lack of cooperation from users	U				4			1
32	Change in ownership or senior management	OE				6			1
33	Conflict between user departments	U				10			1
34	No planning or inadequate planning	P&C					5		1

One of the top ten risk items of South African software projects was identified among the top risk items in all the four developed countries (Canada, Hong Kong, Finland and USA). One was identified by other three developed countries, and five were also picked up by at least one developed country. In total, seven out of 10 top risk items in South African projects were also identified as top risks in at least one developed country.

In the Nigerian study, one top risk was identified as top risks in Hong Kong, Finland and USA. Two risks were also among the top risks in two developed countries, and three also included in the list of top risks in at least one developed country. In total, six out of 10 top risks in the Nigerian study were also among the top risks list of at least one developed country.

Furthermore, the two risk items agreed as top risks in at least three of the 4 developed countries were also identified as top risks in both South Africa and Nigeria. In addition, the top five most frequent items of all the 34 risks were also identified among the top ten risks of both the South African and Nigerian studies. This can be an indication that the most important risk items affecting African software projects are the same as those affecting software projects in the developed countries. Thus, the fourth hypothesis can be defined as:

H04: Software project risks faced by organisations in Ethiopia are the same as those in the developed world.

H14: Software project risks faced by organisations in Ethiopia are different from those in the developed world.

2.9 RISK MANAGEMENT PRACTICE VERSUS PROJECT SUCCESS

Risks are mentioned in research as one of the major factors that cause failure in projects if not addressed well. They may, however, also present an opportunity that can

positively affect the project objectives (Sanchez et al. 2009:16; Ward & Chapman 2003:98).

A number of studies suggest that risk management increases the chance of project success. Bakker et al. (2010:501) suggest that with a proper risk management procedure in place, project stakeholders become aware of arising risks in good time. That helps the stakeholders to adjust their expectations. This, according to Bakker et al., contributes to the success of projects as it reduces the chance of the project failing to meet stakeholders' expectation.

The literature also shows that risk management increases the chances of project success because it shapes the definition of project objectives and improves project control. In addition, it improves the communication between project participants and also facilitates decision making and prioritization of actions (Marcelino-Sádaba et al. 2014:329).

In the Australian study, where a majority of the projects undertook risk identification at the start of the project and put mitigation actions or contingencies in place in advance, all but one project were perceived to be successful. The respondents ranked the successfulness of their project with an average of eight out of 10 (Bannerman 2008:24).

In the South African study, where 60% of the projects under study did not practice any form of risk management, 24 out of 33 respondents (72%) ranked the success rate of their projects below 50%. Only 38% of the respondents considered more than 50% of their projects as successful, and, only one respondent evaluated more than 70% of their projects as successful. In this study, a strong statistically significant positive correlation was found between risk management practice and project success with a p value of 0.0258 (Wet & Visser 2013:21-25).

A research conducted on 415 projects in different industrial sectors in Brazil has shown that the presence of a risk management process influences project success. Junior and Carvalho found a strong correlation between application of risk management and perception of project success. In their study, "care with uncertainties", "individual

knowledge of the business" are the two risk management factors that have presented the most significant relationship with project success (Junior & Carvalho, 2013:72-75). The study suggests that there is a greater chance of project success with undertaking risk management process.

A positive correlation between risk management practice and project success was presented in another research on 100 Israeli projects in variety of industries. In this study, application of risk management techniques and tools was found to have a significant impact on project success in terms of meeting schedule and budget objectives. However, no correlation was found between risk management practice and projects success in terms of meeting functional and technical requirements (Raz, Shenhar & Dvir, 2002:104-105). In conclusion, the authors argue that risk management practices are related to and have positive impact on project success.

Another study conducted on 73 projects across New Zealand, Australia, South Africa and the United Kingdom also agrees with the above findings. The finding by Harvett (2013:138-140) presents a moderate positive correlation between level of implementation of uncertainty/risk management approaches and processes and perceived project success.

A 1997 Microsoft study indicates that a majority of software projects do not incorporate risk management and suffer the consequent high levels of risk. The study suggests that a small amount of overhead investment to risk management can significantly improve the success rate of projects. The analysis shows that a 5% budget devoted to risk management can result in a 50%–75% increase in the opportunity of completing projects on time and within budget (McConnell 1997:93-94).

In agreement with McConnell (1997), Zwikael and Ahn (2011:31) emphasize on the contribution of risk management towards project success. The research concludes that even moderate levels of risk management planning can minimize the impact of risks on projects and bring about a significant improvement in project success.

The above studies and findings show that identifying and addressing risks that can arise in a project can considerably improve the chance of project success. Other authors agree that proper risk management enhances project success not only because it minimizes the adverse effect of risks, but also because it maximizes the potential advantage of risks (Baloch et al. 2014:1524; Chawan, Patil & Naik 2013:60). Therefore, the last two hypotheses of this study are defined as:

H05: Application of formal risk management does not influence success of Ethiopian software projects.

H15: Application of formal risk management influences success of Ethiopian software projects.

H06: Risk management practice does not influence success of Ethiopian software projects

H16: Risk management practice influences success of Ethiopian software projects

2.10 STRENGTHS AND WEAKNESSES OF REVIEWED LITERATURE

The wide area coverage in the topic could be taken as strength in the papers reviewed. The papers cover a range of areas such as the principles of risks and risk management, the importance of risk management, the impact of risks on projects, the top ten risk factors that affect software projects, and the effect of formal and informal risk management on project success, to mention a few. A wealth of research exist suggesting different risk management frameworks. The fact that most of the studies reviewed were conducted in recent years could also be considered as strength. In addition, the risk management practice surveys that are covered in this literature review were conducted in different countries across six continents. This allows readers to have overview of risk management practice in different contexts.

However, most studies lack thoroughness in assessing risk management practice in software projects and its effect in project success. Besides, all the studies were conducted outside Ethiopia, and thus could not reflect the Ethiopian situation. This study envisages contributing to fill that gap and adding to the body of knowledge with the Ethiopian context.

2.11 CONCLUSION

This chapter presented the literature review on the research topic. Despite the significant attention it has acquired amongst academia and the availability of numerous tools, the literature shows that risk management is the least practiced component of the project management process. Studies conducted in Australia, South Africa, Nigeria and 13 other countries across Asia, Europe and the Americas show that only a small proportion of projects employ documented formal risk management procedures. Some projects followed their own defined ad hoc risk management processes and others did not include any risk management component at all.

The most important risks affecting software projects were also discussed in this section. Studies of top ten risk factors conducted on South African, Nigerian, Canadian, Hongkonger, Finish and American projects were discussed. The list of most important software risk factors vary across countries. However, overall, lack of top management commitment and misunderstanding of requirement were the most frequent risk items mentioned by project managers. A majority of the top ten risks identified fall under the system requirement and project planning and control dimensions.

Finally, this chapter discussed the impact of risk management on project success. The literature suggests that project success is affected by low or non-existent risk management. In the Australian study, 71% of projects used formal or semi-formal risk management practice, and a majority rated themselves as successful. On the contrary, 60% of the projects in the South African survey did not use any risk management

process, and 72% of the projects have exhibited less than 50% success (Bannerman 2008:2124, Wet & Visser 2013, 23-26).

These studies are of great importance in providing project managers with a list of most important risks that affect projects in different contexts. The insight on the level of exercising risk management and its impact on project success is also significantly advantageous. However, such documented knowledge is almost non-existent in the Ethiopian context. In lieu of this lack of published studies on the subject reflecting the Ethiopian context, this paper examines the risk management practice in Ethiopian software projects. It explores whether formal risk management procedures are practiced, what phases of the risk management procedures are included in the projects, which risk factors are most affecting the projects, and finally, it inspects the impact of risk management practice on the success of projects.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the research methodology, the study population, sampling technique, data generation method, data collection approach, the research instrument, ethical and legal considerations, and validity and reliability.

3.2 RESEARCH METHODS

Research methodology refers to the approach used to systematically solve the research problem. It explains how the research was done, what approach was chosen to answer the research question, what data collection method was used, and why certain methods or techniques were chosen over others (Jabar 2009:47; Gupta & Gupta 2011:11; Oates 2006:35).

3.2.1 RESEARCH APPROACH

Quantitative research quantifies the problem based on measurement of amount or quantity. It involves generation of numeric data, which is later analysed for patterns that can lead to conclusions. Quantitative research can use survey and experiment for data collection (Jabar 2009:48; Oates 2006:245).

Qualitative research on the other hand is an exploratory research approach that is concerned with subjective assessment. It involves non-numeric data gathering through words, images, sounds and so on. The most commonly used research strategies in

qualitative research are case study, action research and ethnography (Mukul & Deepa 2011: 14; Oates 2006:266; Wabwoba & Ikoha 2011:254).

This study investigated the Ethiopian context of risk management practice by assessing whether the software projects practiced formal or informal risk management, which steps of the risk management process they apply, the type of risk factors projects face, and whether the success of the projects has been affected by their risk management practice, by collecting quantitative data according to the survey research methodology.

Survey is a commonly used and accepted methodology in Information Science research (Oates 2006:93). This study used survey methodology to gather data and compare the findings with other practices in the literature, such as the Australian (Bannerman 2008:2123) and South African (Wet & Visser 2013:23-26) practices which were conducted using the same methodology.

The research questions and the corresponding research approach and data collection methods are summarized below in Table 3.1.

TABLE 3.1: RESEARCH QUESTIONS AND THE CORRESPONDING RESEARCH APPROACH AND DATA COLLECTION METHODS

RESEARCH QUESTION	RESEARCH APPROACH	DATA COLLECTION INSTRUMENT
Are formal risk management procedures applied in Ethiopian software projects?	Quantitative	Questionnaire
Is risk management practiced in Ethiopian software projects?	Quantitative	Questionnaire
Are the risk identification, analysis, mitigation or response, and monitoring and control steps all included in the risk management process?	Quantitative	Questionnaire
What are the top ten risks that are encountered by Ethiopian software projects?	Quantitative	Questionnaire
Is Ethiopian software projects success affected by application of formal risk management standards?	Quantitative	Questionnaire
Is Ethiopian software projects success affected by the risk management practice?		

3.2.2 RESEARCH PHILOSOPHY

This study aimed to explore the risk management practice in Ethiopian software projects and observe their relationship with project success. The study follows the positivist research paradigm, which assumes that the reality exists irrespective of people (Oates, 2006:281-286; Pollard, 2002: 39). Quantitative data was collected on organisations' practice in application of formal models and carrying out risk management steps and rate of project success in terms of meeting time and budget plans and technical requirements. Data was collected using an online questionnaire which was communicated through email and phone calls. In this study, the role of the investigator was only observing the independent and dependent variables and investigating their relationship. There were no instances where the researcher interfered with the phenomenon under study. Hence, the investigator was not a significant variable in this study that could alter the result of the finding. Accordingly, as a positivist research, a similar research with the same participants is expected to produce the same result. The research was carried out employing one of the positivist research approaches, defining hypotheses and investigating the collected data to look for evidence that leads to refutation of the suggested hypotheses (Oates, 2006:284-285).

3.2.3 SAMPLING

Sampling is the process of selecting a group or part of the research population to collect information and draw conclusions. Research can be done by conducting census or selecting a sample of the target population. Census or a complete enumeration requires large amounts of resource, time and energy. Many research are thus done by taking a sample to study a phenomenon and infer conclusion to the larger population (Babbie 2010: 188; Kothari 2004:55; Tayie 2005:31). Due to the limited time and resources available for this research, a sample of the population was studied.

This section describes the target population, the study population, the sampling method employed and the sample size on which the study was conducted.

3.2.3.1 Study population

The study population, also known as the “accessible population”, is part of the population to which the researcher has access. It is the group from which the sample is actually selected (Babbie, 2014:207; Martella, Nelson, Morgan & Merchand-Martella, 2013:53).

This study was conducted on organisations in Addis Ababa, Ethiopia, which have undertaken software projects. The organisations found in Addis Ababa comprise thousands of different types of business companies, governmental organisations or indigenous/international non-governmental organisations. The nature of business companies varies from small ones with few employees to big enterprises with thousands of staff. Information and communication technology is in its initial stage of development in the country. Hence, there is no assurance that all business companies implement software projects. In order to study the software risk management practice, approaching organisations that are known to have established software systems is vital.

The researcher works at a United Nations (UN) agency and had the exposure to multiple other UN agencies most of which are housed in the same compound. Though the investigator did not have an opportunity to explore the infrastructure and software systems of all the UN agencies in Addis Ababa, those within reach were observed to have established Information Communication Technology (ICT) infrastructure and enterprise resource planning and/or desktop software systems. Therefore, UN agencies were included in the study population of this research.

The study population also included banks and insurance companies operating in Ethiopia. Having a sound information management system is a requirement to acquire a banking or insurance license in the Federal Democratic Republic of Ethiopia (Ethiopia, House of Peoples’ Representatives 2008:4207; Ethiopia, House of Peoples’ Representatives 2012:6472). Thus, banks and insurance companies in Addis Ababa were also made part of this study for they are known to undertake software projects to

establish their banking and information management systems as per the country's requirement.

A list of UN agencies was obtained from the United Nations Delivering as One (One UN) website (www.et.one.un.org/index.php?option=com_content&view=article&id=40&Itemid=482). The One UN is part of the UN reform in Ethiopia that brings all agencies in the country together to better support the government of Ethiopia. By the time this study was conducted, twenty six UN agencies were operating in Ethiopia. A list of banks and insurance companies was obtained from the website of the National Bank of Ethiopia, which is the licensing, supervising and regulatory body of Ethiopian banks, insurance companies and financial institutions (www.nbe.gov.et/financial/banks.html; www.nbe.gov.et/financial/insurer.html). Five out of 17 insurance companies have informed the investigator that their IT unit is outsourced. Thus, nineteen banks and twelve insurance companies are included in the list. In total, the sampling frame contains 57 organisations.

To the researcher's knowledge, at the time of the study, no other sector than banks and insurances was obliged to establish an information system. Thus, with the aim of conducting this research on organisations which are known to have information systems in place, the study population was limited to banks, insurances and UN agencies. Though this has resulted in a relatively small sample size, it has helped in saving the time and cost that could have been unnecessarily spent in approaching organisations that have not carried out any software project. Although relatively small in size, the study sample constituted organisations that mobilize huge resources to software projects, thus, even if it cannot be generalized to a larger population, it is believed that the finding gives an insight on the risk management practice in the Ethiopian context.

In conclusion, the study population of this research comprises UN agencies, banks and insurance companies in Ethiopia.

3.2.3.2 Sampling method

A research can be conducted using one or both of the two major sampling methodologies, probability and non-probability sampling. Probability sampling is mainly used if the researcher is interested in studying a sample and generalizing the finding to a wider population. On the other hand, in cases where research is designed more for exploring the research domain than generalizing to a wider population, non-probability sampling is employed (Bhattacharyya 2006: 95; Rubin & Babbie 2009: 355; Oates 2006:97; Tayie 2005:32, Tongco 2007:147-151).

There is no complete list of organisations in Ethiopia that have software systems in place. It would not thus be practical or possible to have a representative sample of the total population for this study. There are thousands of organisations in Ethiopia. However, as Information and Communication Technology is at its initial stage of development in the country, there is no guarantee or proof that all organisations establish or implement software projects. Though the list of organisations can be extracted from an address book or a yellow page, there is no data that lists out organisations that have information systems in place. The probability sampling was thus found to be unsuitable for this study. The non-probability sampling method was therefore chosen for this research focusing on organisations that have information systems in place. It is also believed that careful selection of organisations would matter in producing a result that would be indicative of the situation in Ethiopia. Thus, purposive sampling was employed in this study to conduct the research on a selected domain of organisations: UN agencies, banks and insurance companies. These are organisations that invest hugely in implementation of software projects. The study was conducted in Addis Ababa, Ethiopia.

Purposive sampling is more efficient in producing the required information than random sampling when used appropriately. On the other hand, one of the limitations of purposive sampling is that it is not free from bias. Sample selection in purposive sampling relies on the opinion or judgement of the researcher, which may not always be free from bias. (Bhattacharyya 2006: 95; Oates 2006:98; Tongco 2007:153-154).

However, in this study, purposive sampling was not used to select individual participants, but only to determine a group of organisations that are likely to have information systems in place. The other limitation of purposive sampling arises from the fact that selection of sample depends on the knowledge of the researcher and there is no way to determine the accuracy of the samples (Bhattacharyya 2006: 95; Tongco 2007:153-154).

3.3 CONCEPTUAL FRAMEWORK

This research studies the risk management practice in Ethiopian software projects and examines its correlation with the project success. The independent variable of the study is thus risk management practice in Ethiopian software projects.

Risk management can be carried out by adopting one or more of the available documented formal risk management models. Various formal risk management models are developed and made available for adoption. Examples include Boehm's risk management model, The CMMI risk management model, the PMBOK risk management process, the IEEE risk management process model, and the Riskit risk management framework. Formal risk management models have well-defined and documented steps that allow project managers to control risks and their effect on projects.

Project managers can also define their own ad-hoc risk management process by carrying out some or all of the iterative steps included in formal models. Though the details and iterations of steps may vary, documented formal risk management models commonly include the risk identification, analysis, mitigation and response, and monitoring and evaluation phases (Boehm 1991:34; IEEE 2001:6; Kontio 2001:55; PMI 2013:312-354; SEI, 2010:349). Therefore, the study of the independent variable in this research was conducted by assessing the risk management practice by studying application of formal risk management models and by examining which steps of the risk management process organisations undertake.

This study also examined the major top risk factors affecting Ethiopian software projects. Several risks have been identified in the literature (Dareshuri et al. 2011: Keshlaf & Riddle 2010:22; Tianyin 2011:2979; Wang et al. 2010:1999). Wallace, Keil and Rai (2004:116-118) classified software risks into six dimensions: team, organisational environment, requirements, planning and control, user, and project complexity. The top ten risk items Ethiopian projects are facing was studied by adopting the Wallace et al. classification of risk categories.

The dependent variable of this study is software project success. Various criteria are measured for evaluation of project success, such as time, cost, meeting specification, stakeholder satisfaction, product success, business benefit, scope, resources and risk (Nixon, Harrington & Parker 2012:205; PMI 2013:35; Wateridge 1998:63). Among the different criteria, time, cost and meeting specification, also referred to as the iron triangle, are considered as the basic criteria for measuring project success (Al-Tmeemy, Abdul-Rahman & Harun 2011:338; Atkinson 1999:337-338; Wateridge 1998:61). A project which has failed to meet the expected delivery time, budget or set specification is perceived as a failure (Wateridge 1998:60). The study has thus assessed the success rate of projects by measuring their completion time, budget and extent of meeting specification. The correlation between risk management practice and project success was then investigated.

Figure 3.1 below shows the conceptual model of this study.

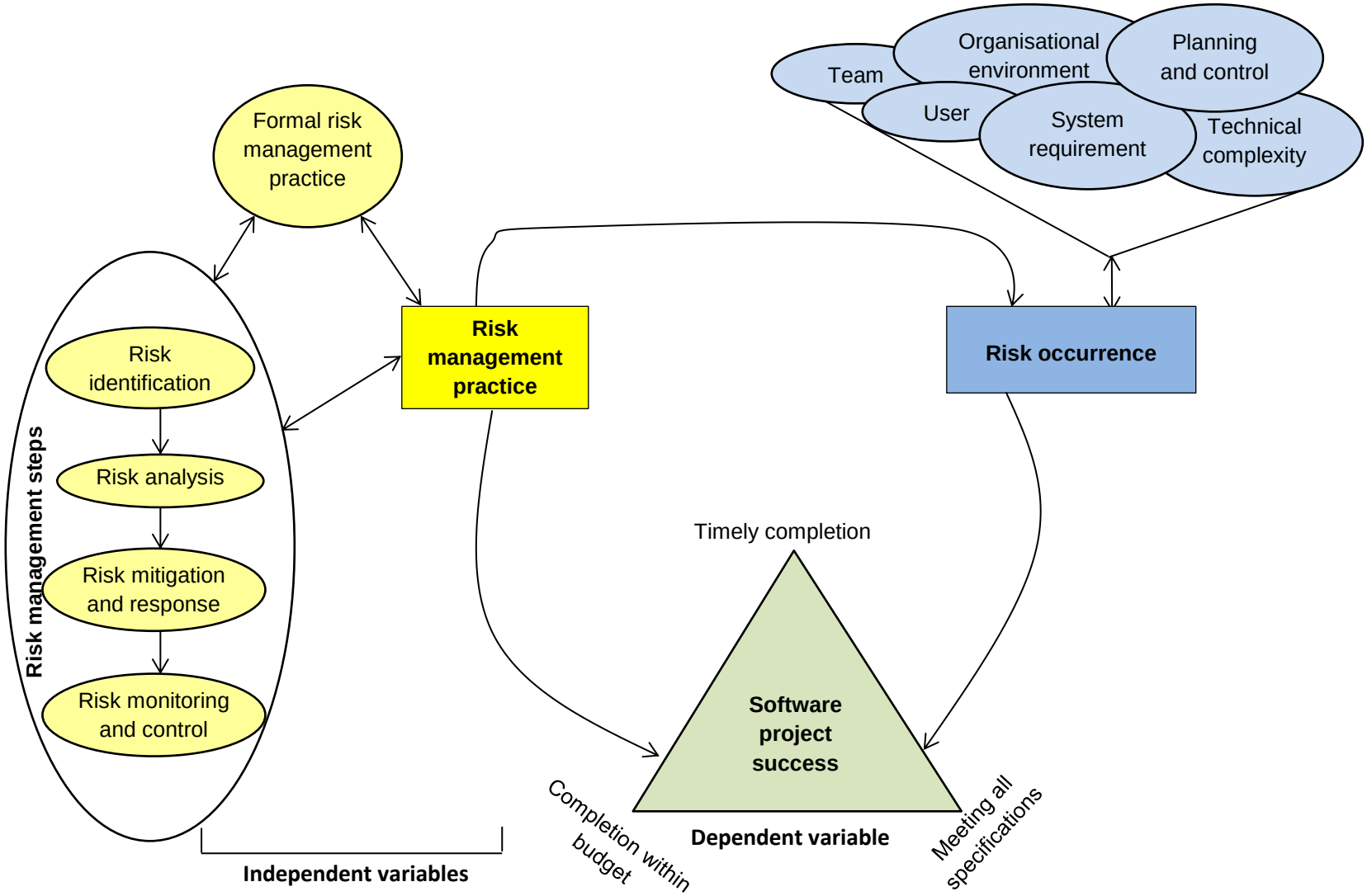

FIGURE 3.1 CONCEPTUAL MODEL

3.3.1 VARIABLES MEASURED IN THE STUDY

Quantitative research is conceptualized with the variables it explains or predicts. A variable refers to a measurable concept that symbolizes an idea, an object, and event, or a person (Hall 2008:60; Rubin & Babbie 2008: 71). The variables measured in this study were practice of risk management, risk occurrence and project success.

The variable types that determine, cause or predict something are called independent variables (Hall 2008:60; Rubin & Babbie 2008: 71). The independent variables in this study were risk management and risk occurrence. The variable that is determined or influenced by the other variables in the study is known as the dependent variable. The dependent variable in this paper is project success.

3.4 DATA COLLECTION

3.4.1 DATA COLLECTION METHOD

The data collection method used for this study was questionnaire. Questionnaire is a widely used data collection tool because it is an efficient way to collect data from a wide range of people (Oates 2006:220).

The instrument included closed ended questions with provision of the 'Other' field, in case the options provided are not comprehensive. Closed ended questions in questionnaires generate standardized data which leads to conclusion (Gillham 2007:5-7; Oates 2006:220).

3.4.2 DEVELOPMENT AND PRE-TESTING OF THE INSTRUMENT

It is important to ensure that the research instrument generates valid, relevant and reliable data. Therefore, the researcher needs to be certain that all aspects of the

research domain are captured in the instrument. The researcher needs to be familiar with the research concept.

Looking at previously used instruments is beneficial as it gives the researcher an opportunity to reuse or adapt questions. It also helps to avoid unnecessary time and effort in designing new questions from scratch (Bradburn, Sudman & Wansink 2004:23; Collins 2003:229; Oates 2006:221-227). A wide range of literature was studied in this research to acquire detailed knowledge of the subject matter. Questionnaires used in other studies were as well examined in developing the structure and content of the instrument (Han & Huang 2007:49; Kajko-Mattsson & Nyfjord, 2008; Kontio, 2001:244-246; Wallace et al., 2004:122-123)

The Literature shows that pre-testing the data collection tool enhances the quality and reliability of the instrument, which in turn results in a better response rate (Faux 2010:106). Pre-testing questions enables one to determine whether the instrument gathers the data the researcher needs, whether the questions are clear and respondents can consistently understand them in the way the researcher intended (Bradburn et al. 2004:317; Collins 2003:231). Bradburn et al. (2004:317) argue that no expert can write a perfect questionnaire on the first draft even after long years of experience, but it is through pre- and pilot-testing that questionnaires can be perfected. They suggest that research should not be conducted unless the instrument can be pre- and pilot-tested.

The first draft of the questionnaire was piloted with two colleagues to assess the wording and clarity of questions. The feedback from the colleagues was used to modify the questionnaire. Then it was submitted to a data management expert colleague, who also has risk management expertise and then to another software development professional for technical comments. Afterwards, the statistical organisation of the instrument was reviewed by a statistician colleague. At each stage, comments were incorporated before sharing with the next level evaluator.

Data collection instrument can further be refined by piloting with potential respondents. (Bradburn et al. 2004:317-319; Faux 2010:104; Oates 2006:226). The questionnaire was piloted with three potential respondents. Three staff members in the United Nations Economic Commission for Africa (UNECA) Information and Technology Support Service, Software Development Section, were approached to fill out the questionnaire and provide their comments. Their inputs were used to further refine the instrument and it was made ready for data collection. The final version was then electronically sent to the research supervisor and approval obtained.

3.4.3 STRUCTURE OF THE INSTRUMENT

The data collection instrument contains a total of 28 questions categorized into five major sections.

- Section I: Biographic and organisational information
- Section II: Project profile
- Section III: Project success
- Section V: Risk management
- Section IV: Project risk factors

The questions were designed in a logical manner whereby less complex questions were asked first (Oates 2006:226). The questionnaire included open ended, dichotomous or yes/no, multiple choice and Likert scale question types. All questions were closed-ended with provision of the 'Other' space in case the response is not found in the list of choices.

3.4.4 DATA COLLECTION PROCESS

Data was collected through the web using an online survey tool. Web surveys are popular and widely used data collection methods. Web surveys add to the convenience of the participants by allowing them to respond at their convenience once they agree to take part in the research. Respondents can take as much time as they need to answer individual questions on online surveys. They are easier, more efficient and less error-prone than paper-based surveys. The flexibility to use form controls such as option buttons, check boxes or drop downs in web surveys adds to the convenience of respondents. Moreover, web survey incurs much less administrative cost to the research process compared to postal survey (Bradburn et al. 2004:302-303; Couper 2000:465; Evans & Mathur 2005:196-201).

However, the major concern in using web surveys is that they produce lower response rates than paper based surveys. Compared to personal interviews, web surveys have limitations in ensuring that respondents clearly understand the survey instructions and questions as they do not provide the possibility of explaining as much as the respondents need. Security is also another concern as respondents may be hesitant to open up links (Bradburn et al. 2004:302-303; Evans & Mathur 2005:202; Fricker & Schonlau 2002: 349-355).

With the purposive sampling method, invitation to participate in this survey was sent to 57 subjects, and continuous follow up was diligently made to maximize the response rate. Pre-testing and piloting were done in developing the data collection instrument in order to improve clarity of the survey instructions and questions.

Many free web survey tools are available on the internet. This study used Google Forms to collect data through online survey. The nature of the survey in this study dictates skipping questions based on the response provided. Google Forms was found to be the most reliable and convenient survey tool that provides the ‘skip’ logic. Moreover, as many people use the Google email and data drive services, security threats are much less of a concern to respondents in using the popular Google product.

3.5 ETHICAL CONSIDERATIONS

An ethical research treats the research participants with fairness and honesty. Research participants have the right to be treated with dignity, and whenever possible, to benefit from the research output. Moreover, participants should not suffer from adverse consequences of the research, in case of any. Ethical obligations in research include the right to voluntarily participate, right to withdraw, right to informed consent, right to anonymity and right to confidentiality (Martella et al., 2013:590-591; Oates, 2006:54-56; Tayie,2005:115-121). This research met the expected ethical requirements of the University by maintaining the rights of participants. An ethical clearance (see Appendix 1) was obtained from the University of South Africa, thereby committing to adhere to the university's ethics policy.

This section presents the ethical considerations of the study and measures taken to meet the ethical obligations.

3.5.1 VOLUNTARY PARTICIPATION

Participation was totally voluntary in this study and in no way forced. Information was provided in the research instrument reassuring that participation is fully voluntary and informants can withdraw from the survey anytime if they so wish. The nature of online survey guarantees voluntary participation as informants can simply ignore invitation and avoid responding if they refuse to participate.

3.5.2 INFORMED CONSENT

Respondents should be provided with information about the true nature of the research (Tayie 2005:116). Informed consent is closely related to voluntary participation. The research subjects were well informed with the aim of ensuring that they volunteer to

take part with full consent. Information about the purpose of the study, the rights of informants, the intended output and benefit of the research was included in the research instrument to assist informants to acquire adequate information about the study. By reading the information provided and proceeding to the questionnaire, subjects provided their consent to participate.

3.5.3 ANONYMITY AND CONFIDENTIALITY

Maintaining anonymity and confidentiality contributes to protection of respondents' privacy. The literature states that anonymity encourages subjects to give honest opinions. In this study, the option to anonymity was provided by making the identity fields optional so that participants can leave them blank if they so prefer. Participants were assured that collected data will strictly be kept confidential. Besides, no identity was ever made public and linked to a particular response (Tayie 2005: 115-222).

3.5.4 PROTECTION FROM HARM

The survey was conducted with no harm to participants. Maintaining confidentiality has contributed to protecting subjects from possible harm and risk that can arise from the research. Once data analysis was completed, collected data was removed from the online storage as a precaution to maintain security.

3.5.5 BENEFIT FROM THE RESEARCH

This research did not aim to generate financial benefit either for the investigator or the participants. Participants could benefit from this study by accessing the final report, which has given a highlight of the risk management practice in Ethiopia and also

identified the common risk factors. The findings of this study were made available for participants by way of a copy of the final report.

3.5.6 REVIEW BY INSTITUTIONAL ETHICS REVIEW BOARD

An application was submitted to UNISA Ethical Clearance Board and clearance was issued on 25 Feb 2015 (See Appendix 1).

3.6 VALIDITY AND RELIABILITY

This section discusses possible threats to validity and reliability of the study and measures taken to overcome them.

3.6.1 VALIDITY

Validity is concerned with the accuracy level with which the research finding reflects the true phenomenon. It looks into the ability of the research instrument to collect the right data and to correctly measure what the researcher intends to measure (LeCompte & Goetz 1982:32; Oates 2006:288).

3.6.1.1 Internal validity

Internal validity measures the extent to which right data was collected from the right informants and whether it measures the phenomenon correctly. It defines the degree to which the study results are the true reflection of reality than results of other factors.

Internal validity can be affected by multiple factors including history, which refers to events occurring during the research; change in subjects' biological or psychological behaviour, known as maturation; instrument decay, which is deterioration of research instrument during the study period; researcher bias and influence; subjects' concern of being measured or tested; diffusion or imitation of treatments, meaning the situation where respondents having the chance to discuss if data collection is conducted in a one after the other manner (Rubin & Babbie 2009: 247-250; Tayie 2005: 23-26).

Different measures were taken to enhance internal validity of this study. Participants' anonymity was ensured in order to avoid their concern of being measured or tested. The likelihood of diffusion of treatments in this study is minimal as respondents were not informed who else is participating. Presentation of the research instrument was performed in a consistent way, which helped to eliminate researcher influence. All organisations within the identified group were included in the sampling, which helped to ensure representativeness, thereby improving internal validity.

History, maturation and instrument decay were not key concerns for this study as the data collection period did not take longer than two months.

3.6.1.2 External validity

External validity is concerned with the generalizability of the research finding to a wider population (LeCompte & Goetz 1982:32).

Purposive sampling does not intend to generalize the conclusion, rather it emphasizes on gathering and analysing quality data from willing and capable informants. It provides reliable and robust data and contributes to internal validity but does not guarantee external validity (Tongco 2007:154).

3.6.2 RELIABILITY

Reliability refers to the repeatability of the research. It measures how honest and truthful the response was. A question is asked, “Will the instrument yield the same result if used again with the same informant?” (Oates 2006: 94,288).

Due attention was given to avoiding leading questions in the research instrument. Questions were carefully designed to ensure neutrality. Successive pre- and pilot-testing were conducted in order to improve the likelihood of respondents’ understanding questions in the same way, in turn, improving reliability (Oates 2006:287; Tongco 2007:155).

3.7 CONCLUSION

This chapter looked into the research approach employed in this study, which used quantitative research paradigm with survey methodology. Data was collected using online questionnaire. Purposive sampling was employed in order to include organisations that were likely to have implemented at least one information systems project. The sample comprised of 57 banks, insurance companies and UN agencies in Ethiopia.

Measures taken to ensure compliance with ethical obligations and methods followed to improve validity and reliability of the research were also discussed in this chapter.

CHAPTER 4

ANALYSIS AND PRESENTATION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

The purpose of this chapter is to present the findings of the research and to provide statistical analysis of the collected data. It will present analysis of the findings on organisational and project profiles, project success rate, application of formal risk management models, risk management practice, and top ten risk items occurring in the projects. It also discusses the results of Fisher's exact test between application of formal risk management and project success, and also between risk management practice and project success.

4.2 DATA COLLECTION AND MANAGEMENT

Data collection was conducted over a period of 2 months between mid-August and mid-October 2015. Initially, email invitations were sent to the organisations' official email addresses with a note indicating attention to IT unit. However, this did not result in any response, and therefore, Software Development Heads of the organisations were approached over telephone and were requested to participate in the survey. During the telephone conversations, the purpose of the research was explained and email addresses of the Managers were collected. Email invitations were then sent out to the collected addresses with the link to the online survey. Repeated reminders were sent to each participant in order to remind and encourage project managers to respond to the survey.

Data collected through Google Forms was exported to Microsoft Excel and then transferred to SPSS version 20.0 for analysis. Microsoft Excel was very helpful in analysing collected data using pivot tables and charts. SPSS has also helped in statistical computations with a graphical user-friendly interface.

4.3 RESEARCH FINDING

The research findings are discussed in this section. Findings are presented in text descriptions and using tables, graphs and charts.

4.3.1 DEMOGRAPHICS

4.3.1.1 Sample size and response rate

An invitation message was sent to software project managers in 57 organisations. Of the total number of project managers, 45 provided their response by completing the questionnaire. This makes the response rate 79%. The survey allowed submission only if all the mandatory fields were answered, ensuring complete response to the questionnaire items. No data was therefore discarded.

There were no missed questions other than those which are skipped based on the response of the previous questions.

4.3.1.2 Organisation profiles

This survey was conducted using purposive sampling with a study population of banks, insurance companies and UN agencies in Ethiopia. Respondents were asked to indicate the type and size of their organisation. Forty per cent (40%) of the respondents

in this study were from banks, another 40% from UN agencies and the remaining 20% from insurances.

Fifty three per cent (53.3%) of the organisations under study have above 500 employees. Another 40% have between 100 and 500 employees. Only 6.7% of the organisations have indicated that they have 10 – 50 employees. Table 4.1 below summarizes the proportion of organisation types and size.

TABLE 4.1: SUMMARY OF ORGANISATION PROFILE (N=45)

ORGANISATION SIZE	ORGANISATION TYPE			
	BANK	UN ORGANISATION	INSURANCE COMPANY	TOTAL
10 – 50 employees	0	2	1	**3**
100 – 500 employees	5	5	8	**18**
Above 500 employees	13	11	0	**24**

4.3.1.3 Project profiles

Respondents were asked six questions to assess the project type, implementation method and planned budget and also the status of project schedule, budget implementation and meeting specification at the completion of the projects.

Project type

More than half of the total projects under study (55.6%) were off-the-shelf software customizations. New software development accounted to 35.6% and the remaining 8.9% were upgrade of an existing software system.

Project implementation

Of the projects in the survey, 62.2% were outsourced to an international vendor, and 8.9% were outsourced to joint local and international vendors. The remaining 28.9% were developed in-house.

Project budget

Budget wise, 27 projects (60%) were allocated with a budget of more than Ethiopian Birr (ETB) 1,000,000 (USD 50,000). Two projects (4.4%) were planned with a budget of between ETB 500,001 and 1,000,000 (USD 25,001 – 50,000), one project (2.2%) between ETB 100,000 and 500,000 (USD 5, 001 – 25,000). Three projects (7%) were allocated with less than ETB 100,000 (USD 5,000). Three respondents (7%) were uncertain on the amount of budget allocated for the projects and the remaining 9 projects (20%) were not allocated with a specific budget.

Project schedule status

A large proportion of projects under study have shown delay in their schedule. Projects with delay in their implementation schedule accounted for 71.1% of the total number of projects, while 26.7% of the projects have been going on as per the planned schedule. One project has been going on ahead of planned schedule.

Project budget utilization

Only 18 projects (40%) have utilized the same budget or less than initially estimated. Another 40% have exceeded the budgeted amount. Nine project managers (20%) have indicated that they don't have adequate information on the status of budget implementation of the projects.

Project meeting specification

Of the total projects, 27% have met their initial specification in full, and 42% met the majority of their specification. While 4% met half, 22% did not meet their specifications at all. Another 4% of the respondents were uncertain about the level of meeting specification. A summary of project profiles is shown below in Table 4.2.

TABLE 4.2: SUMMARY OF PROJECT PROFILE (N=45)

PROJECT PROFILE	NO OF PROJECTS					
PROJECT TYPE						
New software development	16					
Off-the-shelf customization	25					
Upgrade	4					
PROJECT IMPLEMENTATION						
In-house developed		13				
Outsourced for international vendor		28				
Outsourced to a joint local and international vendors		4				
PROJECT BUDGET						
<100.000 ETB			3			
100,000 – 500,000 ETB			1			
500,001 – 1,000,000 ETB			2			
>1,000,000,000 ETB			27			
Uncertain about the estimated budget			3			
PROJECT SCHEDULE STATUS						
Ahead of time				1		
On-time				12		
Delayed				32		
PROJECT BUDGET UTILIZATION						
Consumed more budget					18	
Consumed same budget as planned					15	
Consumed less budget					3	
Uncertain about the budget utilization					9	
PROJECT MEETING SPECIFICATION						
Fully						12
In majority						19
Average						2
Not at all						10
Uncertain						2

4.3.2 PROJECT SUCCESS

Time, cost and meeting specification are the first three criteria looked at in evaluating project success. They are also referred to as the iron triangle and are considered the basic criteria in measuring project success (Al-Tmeemy, Abdul-Rahman & Harun 2011:338; Atkinson 1999:337-338; Wateridge 1998:61). Studies suggest that they are easy, timely and the most common combination of criteria that have long been used to measure project success (Anda & Sjøberg 2009:413; Savolainen, Ahonen & Richardwon 2012:458; Kaur & Sengupta 2011:3). A project which was not delivered on

time, within or under budget and with the defined specification is perceived as a failure (Wateridge 1998:60).

However, many authors criticize these three criteria for being inadequate and suggest that other parameters should be added to measure project success (Al-Tmeemy et al. 2011:338; Westerveld 2003:412; Toor & Ogunlana 2010: 229; Wateridge 1998:63). Nixon, Harrington and Parker (2012:205) state that critical project success measurement criteria have been expanded from the three basic factors. They argue that the measure of project success includes more quality-based factors such as stakeholder satisfaction, product success, business and organisation benefit, and team development in addition to cost, time and functionality improvement. The PMBOK defines the criteria that determine project success as scope, time, cost, quality, resources and risk (pmi, 2013:35).

Although completion of project within agreed time, budget and meeting the required functionality does not guarantee success of a project, as the three are the basic criteria, failure in meeting one of the above accounts to failure of the project (Anda et al. 2009:412; Atkinson 1999:341).

Even though project success criteria are much wider than just budget utilization, time consumption and the extent to which the agreed specification was met, due to time limitation, this research has investigated only the three parameters and categorized the projects under study as ‘a success’ or ‘a failure’ based on the findings. Projects which were completed on time, within budget and meeting specification fully or in majority were considered as succeeded and those which did not meet these criteria were regarded as failed.

4.3.2.1 Time and budget utilization and meeting specification of projects

A majority of the projects were delayed. Specifically, 71.1% have taken more time than initially estimated and 26.7% were completed on time. Only one project was finalized ahead of time. Also, 40% of projects have exceeded their allocated budget. Looking at utilization of budget, 6.7% of the projects consumed lesser budget than estimated while 33.3% were completed within budget. Another 20% of respondents indicated they don't have adequate information on the status of budget utilization of the projects.

TABLE 4.3: SUMMARY OF THE STATUS OF BUDGET AND TIME UTILIZATION OF COMPLETED PROJECTS (N=45)

PROJECT BUDGET UTILIZATION	PROJECT SCHEDULE STATUS			
	AHEAD OF THE PLANNED SCHEDULE	RIGHT ON THE PLANNED SCHEDULE	DELAYED	TOTAL
Lesser budget	0	0	3	**3**
Same budget as estimated	0	9	6	**15**
More budget	1	1	16	**18**
Uncertain	0	2	7	**9**
Total	**0**	**12**	**32**	**45**

Table 4.3 (above) illustrates a summary of the status of budget and time utilization of projects. The data shows that only 9 out of 45 projects were completed on time and within budget. The remaining 36 projects have overrun either the estimated schedule or budget.

Cross tabulation of budget utilization and the extent of meeting specification of the thirteen projects which were completed on time or ahead of schedule resulted in the following summary shown in table 4.4 below.

TABLE 4.4: CROSS TABULATION OF RESPONSES TO BUDGET UTILIZATION AND THE EXTENT OF MEETING SPECIFICATION OF TIMELY COMPLETED PROJECTS (N=45)

PROJECT BUDGET UTILIZATION STATUS	TO WHAT EXTENT HAS THE PROJECT MET THE INITIAL SPECIFICATION?					
	FULLY	IN MAJORITY	AVERAGE	NOT AT ALL	UNCERTAIN	TOTAL
I don't know	0	0	0	0	1	**1**
It has taken lesser budget than estimated	0	0	0	0	0	**0**
It has taken more budget than estimated	2	3	1	3	0	**9**
It has taken the same budget as estimated	1	2	0	0	0	**3**
Total	**3**	**5**	**1**	**3**	**1**	**13**

Table 4.4 above portrays that only one project was completed on time, within budget and meeting full specification. Two out of 45 projects were completed on time, within budget and meeting a majority of the agreed specifications. Taking the time, budget and specification parameters as a measure for project success (Kaur & Sengupta 2011:3; Nixon et al. 2012:205), the finding implies that only 5 out of 45 projects were successes, including those which were said to have met a majority of the specified requirement.

One possible reason for this may be application of new technology in project execution. Use of new technology was the highest scored risk item by project managers in this study. It was also emphasized in Jiang and Klein (2000:3) that use of leading edge technology is an increasing risk. Han and Huang (2007:48) spotted new technology as one of the top ten software risks.

High level of complexity of task could also be one of the reasons for the overrun of budget and schedule. Jiang and Klein (2000:4) suggest that application complexity could affect project budget and schedule more significantly than other risks. The finding of the survey further strengthens this reasoning, as the top five risks identified by the respondents were technical complexity risks (see section 4.3.6 below).

Another reason could be inadequate estimation of schedule, as identified by respondents as the 6th most important risk, consistent with the finding of Addison and Vallabh in the South African study (2002:134) and Schmidt (2001:21) in the Finnish study.

4.3.3 APPLICATION OF FORMAL RISK MANAGEMENT MODELS

Participants were requested to indicate if they apply formal risk management techniques. The test produced a sample mean of 16% of the participants that applied formal risk management. Further, 11.1% employed the IEEE framework and 6.7% applied the Boehm's risk management framework. The Riskit model was used in only 1 organisation. A hypothetical target mean of 50% was considered for passing the test. The sampled mean (16%) was much lesser than the target mean. There was no need, therefore, to run a statistical test for the statistical significance. The null hypothesis, H01, could not therefore be refuted and it was not possible to conclude that formal risk management is applied in Ethiopian software projects.

The result of this finding was low compared to the Australian assessment. Bannerman (2008:2124) found that five out of 17 projects (29%) used formal risk management techniques. On the other hand, the proportion of this result was higher than the South African finding, in which only 3% of the projects used formal procedures.

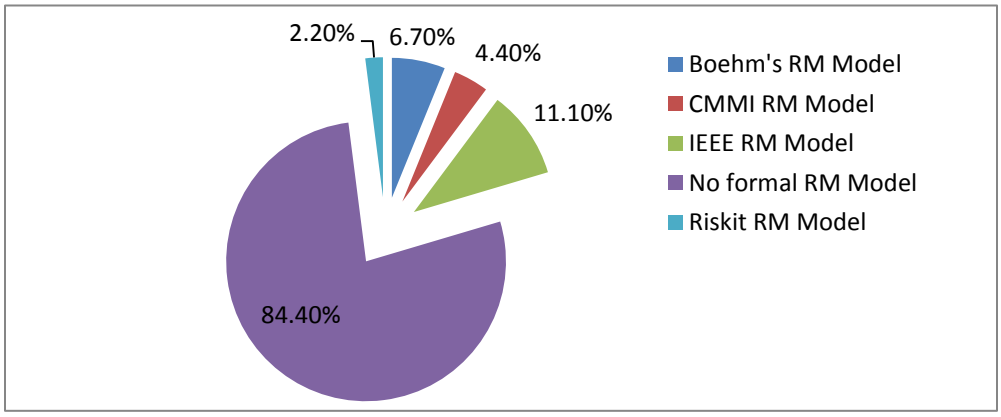

FIGURE 4.1: SUMMARY OF RESPONSES TO USAGE OF FORMAL RISK MANAGEMENT MODELS

4.3.4 RISK MANAGEMENT PRACTICE

Organisations' practice of risk management was investigated by asking participants if they conduct one or more of the identification, analysis, mitigation or response, and control and monitoring phases of the process. The result showed that 67% of the organisations practiced risk management by conducting one or more of the phases of the process. This result is in close proximity with the Australian finding whereby 71% of the projects indicated that they applied either formal, semi-formal or informal risk management procedures (Bannerman 2008:2124-2125). However, this finding is larger compared to the South African survey, which showed that 40% of the projects included one or more steps of the risk management process (Wet & Visser 2013:25).

A one-sample T-Test was applied to test the statistical significance of the mean value being greater than 50%. The test produced a statistically significant value with $p<0.001$, which resulted in refutation of the second null hypothesis. It can thus be concluded that risk management is practiced in Ethiopian software projects.

TABLE 4.5: ONE-SAMPLE TEST OF RISK MANAGEMENT PRACTICE (N=45)

	TEST VALUE = 50						
	t	df	Mean	SIG. (2-TAILED)	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL OF THE DIFFERENCE	
						LOWER	UPPER
Risk management practiced	-694.182	44	.67	.000	-49.333	-49.48	-49.19

4.3.5 STEPS INCLUDED IN THE PRACTICE OF RISK MANAGEMENT

Five questions were asked to assess which steps organisations carry out in the risk management process. The finding of the result showed that 42% of projects identified

risks at the start of the projects. Another 42% of projects were started without carrying out risk identification. The remaining 16% of the respondents were uncertain whether risk identification was undertaken at the beginning of the projects or not. Checklists and team meetings were among the techniques used for risk identification by the majority of these projects. Thirty one per cent (31%) of the respondents reported that they use checklists and team meetings were used by a similar proportion. A few respondents (13%) conducted interviews to identify risks. Consistent findings were reported in Nigeria. Adeleye et al. (2004:176-177) found that only 48.5% of the banks under study identified the risks associated with the projects. Bannerman's finding in the Australian study produced a much higher result. In that study, 42% of projects that did not adopt formal models conducted risk identification. Together with the 29% which applied formal standards, 71% of the Australian projects under study identified their risks (Bannerman 2008:2124-2125).

According to the responses, only part of the organisations that identified risks proceeded with risk analysis. The results showed that 33% organisations analysed and prioritized the identified risks. One respondent was uncertain whether risk prioritization was undertaken or not while 7% of the organisations identify risk, but do not conduct analysis and 22% of the projects performed risk prioritization based on both likelihood of occurrence and magnitude of impact. Also, 11% of projects based their risk prioritization only on magnitude of impact.

In this study, 38% of the participants indicated that they put a mitigation and response plan in place to keep control of the risks and their impact. Controlling and monitoring mechanisms were put in place by 51% of the projects. Of the organisations that reported presence of risk control and monitoring, 38% conducted risk identification at the beginning of the projects, while the remaining 13% indicated that although they did not identify risks at the beginning of their projects, they kept an eye to monitor occurrence of risk during the execution of projects.

This is in compliance with the Nigerian finding. Adeleye et al. (2004:176-177) showed that 42.8% carried out risk analysis and prepared risk mitigation and response plans.

The Australian study produced a higher proportion. Bannerman (2008:2125) found that all the projects that undertook risk identification also prepared mitigation or contingency plans, and also assigned responsibility for risk monitoring. Wet and Visser (2013:25) indicated that 40% of the projects applied one of the IEEE software risk management steps. Nevertheless, it was not indicated in their study which steps the projects performed.

Overall, 27% of the organisations which exercised risk management undertook all the identification, analysis, mitigation or response, and control and monitoring steps. The result is much lower than 50%, thus H03 could not be rejected and it was not possible to conclude that all the steps or risk management process are carried out.

Figure 4.2 below shows an illustration of the execution of steps of the risk management procedure in the Ethiopian software projects.

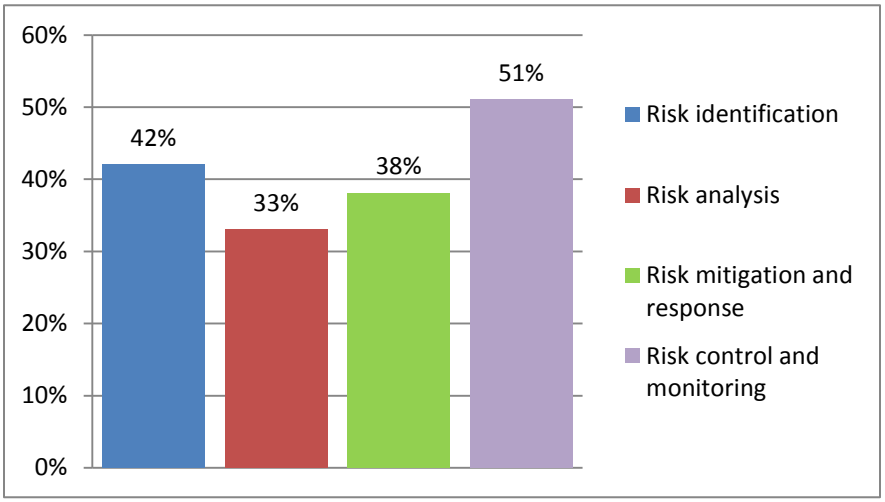

FIGURE 4.2: STEPS INCLUDED IN THE RISK MANGEMENT PRACTICE OF ORGANISATIONS

4.3.6 OCCURRENCE OF PROJECT RISKS

The last six questions of the research instrument listed risk items requesting respondents to score the level of their occurrence in the projects. The study adopted the Wallace, et al. (2004:122-123) categorization of the most common software project risk factors into six dimensions as team, organisational environment, requirements, planning and control, user, and project complexity. A total of 44 risk items were listed under the six categories. Respondents were asked to give their opinion on the extent to which these risk items have occurred in their projects using a Likert scale of five categories. Respondents' total score for occurrence of risks was calculated by summing up weights of the items using the weighing values presented in Table 4.6 (Ary, Jacobs, Sorensen & Razavieh 2009:209-211). All items were positively stated; therefore, the higher the total score, the stronger the occurrence of risks and vice versa. For ease of analysis, "strongly agree" and "moderately agree" were clustered into "agreed" and "moderately disagree" and "strongly disagree" were clustered into "disagreed" in presenting the total scores.

TABLE 4.6: WEIGHING VALUES FOR SCORING ITEMS ON RISK OCCURRENCE

SCORE	WEIGHT
Strongly agree	5
Moderately agree	4
Neutral	3
Moderately disagree	2
Strongly disagree	1

4.3.6.1 Team risks

In the Wallace et al. categorization of risk factors, the risk items that fall under the team dimension are frequent conflicts, frequent turnover, team members not being familiar with the tasks being automated, team members lacking specialized skills required by the project, inadequately trained team members, lack of commitment to project among

development team members, and inexperienced team members (Wallace, et al. 2004:122).

The result of respondents in this category produced a mean value of 2.77, which indicates moderate occurrence of team risks in the projects. As seen in the responses, 46.7% of the respondents indicated that team members were not familiar with the tasks being automated. The team members lacked the required specialized skills in 44.4% of the projects, and 35.6% of the projects faced frequent turnover of the project team. A similar proportion of the projects had team members who were not adequately trained, and 33.3% of the development team members were not well experienced. Frequent conflicts were exhibited in 26.7% of the projects. Only 24.4% said that the project team members lacked commitment. Table 4.7 shows summary of respondents' scores for occurrence of team risks.

TABLE 4.7: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF TEAM RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
There was frequent turnover within the project team	16	35.6	13	28.9	16	35.6	45	100	2.98
Team members were not familiar enough with the tasks being automated	21	46.7	5	11.1	19	42.2	45	100	2.87
Team members lacked specialized skills required by the project	20	44.4	7	15.6	18	40.0	45	100	2.89
The development team members were not adequately trained	16	35.6	7	15.6	22	48.9	45	100	2.80
The development team members demonstrated lack of commitment to the project	11	24.4	11	24.4	23	51.1	45	100	2.53
The development team members were not well experienced	15	33.3	6	13.3	24	53.3	45	100	2.73
There were frequent conflicts between development team members	12	26.7	9	20.0	24	53.3	45	100	2.60
Overall mean of occurrence of team risks									**2.77**

4.3.6.2 Organisational environment risks

The common risk factors categorized under organisational environment dimension by Wallace et al. are lack of top management support, change in organisational management during the project, organisation undergoing restructuring during the project lifetime, unstable organisational environment, corporate politics, and shifting of resources away from the project because of changes in organisational priorities (Wallace, et al. 2004:122).

Organisational risks are the least agreed-upon category of risks to occur in the projects. A change in the organisational management occurred in 31.1% of the projects and 26.7% have undergone through organisational restructuring. Lack of support for the project by senior management was exhibited in 24.4% projects, and 15.6% projects were undertaken in unstable organisational environment. Also, 28.9% were negatively affected by corporate politics. Resources were shifted away from 8.9% projects because of changes in organisational priorities. The result showed a mean value of 2.31, which shows a moderate level of occurrence of risks categorized under this dimension.

TABLE 4.8: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF ORGANISATIONAL ENVIRONMENT RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
There was no adequate top management support for the project	11	24.4	6	13.3	28	62.2	45	100	2.29
There was change in organisational management during the project	14	31.1	6	13.3	25	55.6	45	100	2.47
The organisation has undergone restructuring during the project	12	26.7	8	17.8	25	55.6	45	100	2.56
The organisational environment was unstable	7	15.6	8	17.8	30	66.7	45	100	2.18
Corporate politics has negatively affected the project	13	28.9	6	13.3	26	57.8	45	100	2.40
Resources were shifted away from the project because of changes in organisational priorities	4	8.9	10	22.2	31	68.9	45	100	1.93
Overall mean of occurrence of organisational risks									**2.31**

4.3.6.3 Project system requirement risks

Project system requirement risk factors include incorrect, conflicting, unclear, continually changing or inadequately identified system requirements, undefined project success criteria, difficulty in defining the inputs and outputs of the system, and lack of understanding of the system capabilities and limitations by users (Wallace, et al. 2004:122-123).

The majority of respondents agreed that the project system requirements were continually changing and users lacked understanding of system capabilities and limitations. The mean values of the two items, respectively, are 3.16 and 3.13. Also, 37.8% of the respondents agreed that the project success criteria were not defined. System requirements were inadequately identified in 35.6% projects and incorrectly defined in 20%. Seventeen (8%) projects had unclear requirements and 13.3% had conflicting ones. Users lacked understanding of capabilities and limitations of the systems under development in 21 projects (46.7%). The overall mean of participants' score in this dimension 2.52, which exhibits a moderate level of occurrence of system requirement risks in the projects.

TABLE 4.9: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF PROJECT SYSTEM REQUIREMENT RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
The project success criteria were not defined	17	37.8	5	11.1	23	51.1	45	100	2.73
The system requirements were not adequately identified	16	35.6	3	6.7	26	57.8	45	100	2.49
The system requirements were incorrectly defined	9	20.0	5	11.1	31	68.9	45	100	2.11
The system requirements were unclear	8	17.8	5	11.1	32	71.1	45	100	2.13
The system requirements were conflicting	6	13.3	9	20.0	30	66.7	45	100	2.04
The system requirements were continually changing	23	51.1	4	8.9	18	40.0	45	100	3.16
The inputs and outputs of the system were not defined clearly	13	28.9	2	4.4	30	66.7	45	100	2.36
Users lacked understanding of system capabilities and limitations	21	46.7	7	15.6	17	37.8	45	100	3.13
Overall mean of occurrence of system requirement risks									**2.52**

4.3.6.4 Project planning and control risks

Nine risk factors were categorized under project planning and control by Wallace et al. (2004:123). These are unclear project milestones, inadequately monitored project progress, ineffective project management methodology, inexperienced project manager, poor project planning, lack of "people skills" in project leadership, ineffective communication, inadequate estimation of required resources, and inadequate estimation of project schedule (Wallace, et al. 2004:123).

The participants of this survey are project managers. The investigator believed that the scoring to one of the above components, "inexperienced project manager", would result in a bias. Another component, "lack of 'people skills' in project leadership", was believed to be ambiguous. Thus, the investigator decided not to include the two components in the survey and respondents were asked to provide their opinion on the other seven risk factors.

TABLE 4.10: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF PROJECT PLANNING AND CONTROL RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
Project milestones were not clearly defined	13	28.9	4	8.9	28	62.2	45	100	2.44
Project progress was not monitored closely enough	16	35.6	2	4.4	27	60.0	45	100	2.47
The project management methodology was ineffective	12	26.7	11	24.4	22	48.9	45	100	2.56
The project planning was ineffective	13	28.9	9	20.0	23	51.1	45	100	2.56
The communication among the project stakeholders was ineffective	19	42.2	1	2.2	25	55.6	45	100	2.73
The required resources were inadequately estimated	14	31.1	10	22.2	21	46.7	45	100	2.78
Project schedule was inadequately estimated	23	51.1	2	4.4	20	44.4	45	100	3.18
Overall mean of occurrence of project planning and control risks									**2.67**

As can be seen in the summary Table 4.10 (above), project schedule was inadequately estimated in 51.1 % of the projects, and estimation of the required resources was inadequate in 31.1%. Also, 42.2% of the projects faced ineffective communication among the project stakeholders. Project milestones were not clearly defined in 28.9% of the projects, and a similar proportion of projects had ineffective project planning. Sixteen (35.6%) respondents showed that project progress was not monitored closely enough. The project management methodology of 26.7% projects was ineffective. All items except inadequate estimation of schedule resulted in mean values of less than three, which shows disagreement to the occurrence of project planning and control risks. Overall, the result exhibited a moderate occurrence of planning and control risks, with a mean value of 2.67.

4.3.6.5 User risks

The risk factors associated with users are lack of cooperation, resistance, lack of commitment, lack of participation, conflict and negative attitudes (Wallace, et al. 2004:123).

Users' participation was rated low in 44.4% of the projects. Twenty one (46.7%) of the respondents indicated that there was lack of adequate user understanding of the system capabilities and limitations, and 40% faced user resistance. In 17 projects (37.8%), users demonstrated low level of commitment and they were not cooperative in 33.3% projects. Conflicts were exhibited among users in 26.7% of the projects and users had negative attitudes towards 7 projects (15.6%). Summary of respondent scores is illustrated in Table 4.11 below. A mean value of 2.68 of this dimension indicates moderate occurrence of risks.

TABLE 4.11: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF USERS RELATED RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
Users did not cooperate well in the project implementation	15	33.3	3	6.7	27	60.0	45	100	2.62
Users demonstrated resistance to change	18	40.0	6	13.3	21	46.7	45	100	3.00
Users were not committed enough to the project	17	37.8	4	8.9	24	53.3	45	100	2.80
Users did not participate at the required level	20	44.4	4	8.9	21	46.7	45	100	2.96
Users had negative attitudes towards the project	7	15.6	11	24.4	27	60.0	45	100	2.20
Conflicts were demonstrated among users	12	26.7	8	17.8	25	55.6	45	100	2.49
Overall mean of occurrence of user risks									**2.68**

4.3.6.6 Technical complexity risks

Risks in the technical complexity dimension include use of technology that has not been used in prior projects, use of new technology, use of immature technology, large number of links to other systems, high level of technical complexity, involvement of many external suppliers, highly complex task being automated, and the project's being one of the largest projects attempted by the organisation (Wallace, et al. 2004:123).

Technical complexity risks have been rated as the highest occurring of all the dimensions. As can been seen from Table 4.12 below, five out of 8 items have shown scores of mean values greater than 3.

The majority of the projects (75.6%) involved use of new technology. Thirty three projects (73.3%) were denoted as one of the largest projects attempted in the organisation. Thirty projects (66.7%) involved automation of a highly complex task and 57.8% of the projects had high level of technical complexity. Twenty nine (64.4%) of the projects involved technology that has not been used in prior projects. Fifteen projects (33%) had a large number of links to other systems and 13 projects (28.9%) involved

many external suppliers in the development. Only 11.1% agreed that their projects involved use of immature technology.

TABLE 4.12: RESPONDENTS' TOTAL SCORE FOR OCCURRENCE OF TECHNICAL COMPLEXITY RISKS (N=45)

RISK ITEM	AGREED		NEUTRAL		DISAGREED		TOTAL		MEAN
	N	%	N	%	N	%	N	%	
The project involved use of technology that has not been used in prior projects	29	64.4	4	8.9	12	26.7	45	100	3.47
The project involved use of new technology	34	75.6	4	8.9	7	15.6	45	100	3.93
The project involved use of immature technology	5	11.1	11	24.4	29	64.4	45	100	2.16
The project required large number of links to other systems	15	33.3	4	8.9	26	57.8	45	100	2.60
High level of technical complexity	26	57.8	4	8.9	15	33.3	45	100	3.44
The project was one of the largest projects attempted by the organisation	33	73.3		0.0	12	26.7	45	100	3.87
Many external suppliers were involved in the development project	13	28.9	9	20.0	23	51.1	45	100	2.64
The task being automated was highly complex	30	66.7	3	6.7	12	26.7	45	100	3.56
Overall mean of occurrence of technical complexity risks									**3.21**

The mean value of respondents' score for this dimension was 3.21, which indicates a high occurrence of risks associated with technical complexity.

4.3.6.7 Summary of scoring of risks

The result of participants' scoring of risk items shows that the type of risks the projects have faced most is technical complexity. Figure 4.3 below shows the graphical presentation of mean scores of occurrence of risk items in the six dimensions. The figure shows that a majority of the technical complexity risks were given higher scores. The maximum score was given to the technical complexity risk item 2, 'the project involved use of new technology', indicating a high tendency of adoption of new tools

and techniques in executing software projects; a majority of the risks stem from this. Overall, as can be seen from Figures 4.3 and 4.4 below, the technical complexity risk dimension scored the highest with a mean value of 3.21.

The risk item that scored the least was an organisational environment risk item, 'resources shifted away from the project because of changes in organisational priority', with a mean value of 1.93. The risk dimension that received the maximum number of items with the lowest score is the system requirement dimension. 'Unclear system requirements', 'incorrectly defined requirements', and 'conflicting requirements' were among the last four lowest scores. However, overall, the organisational environment risk dimension received the least score, with a mean value of 2.31.

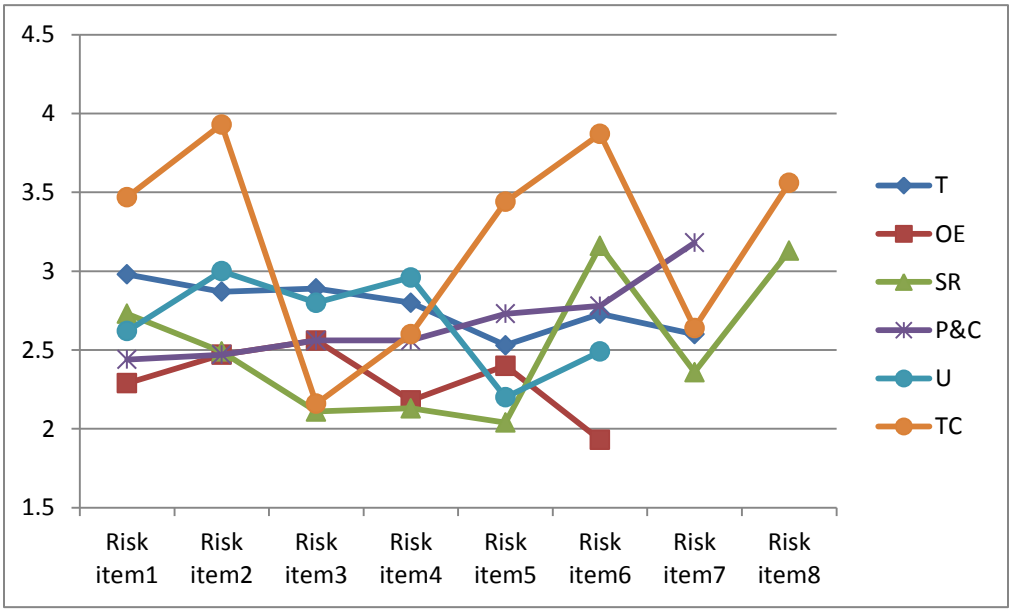

FIGURE 4.3: MEAN SCORES OF RISK ITEMS IN THE SIX DIMENSIONS

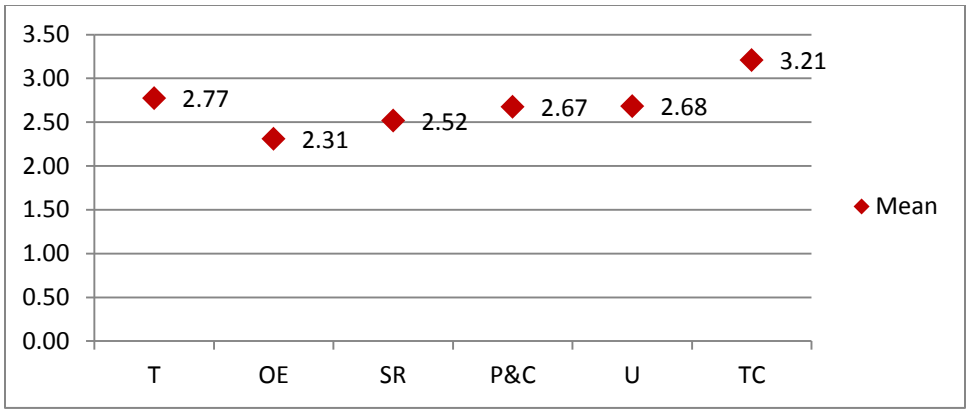

FIGURE 4.4: MEAN SCORES OF RISK DIMENSIONS

Based on the finding, the order of risk occurrence in the projects by dimension was: technical complexity, team risk, users, project plan and control, system requirement and organisational environment. This is consistent with the finding of Han and Huang (2007:46) which concluded that "project complexity" is a frequently occurring dimension, and "organisational environment" is the least frequent dimension.

A one-sample T-Test test was applied to test the statistical significance of the mean values of the scoring of risk occurrences. The average mean of acceptance of occurrence of risk items was computed by calculating the average score weights of 'strongly agree' (5), 'moderately agree' (4) and 'neutral' (3). Thus, the T-Test was applied with a target mean of 4, ((3+4+5)/3). The result of the T-Test showed a high statistical significance with $p < 0.001$. Therefore, the null hypothesis, H04, was refuted showing that software project risks faced by organisations in Ethiopia are different from those identified by the literature.

TABLE 4.13: ONE-SAMPLE T-TEST OF SCORRING OF RISK OCCURRENCE (N=45)

	TEST VALUE = 4					
	t	df	SIG. (2-TAILED)	MEAN DIFFERENCE	95% CONFIDENCE INTERVAL OF THE DIFFERENCE	
					LOWER	UPPER
Risk occurrence mean	-8.034	44	.000	-1.01839	-1.2738	-.7629

4.3.6.8 Top ten risk items

Based on the result of the participants' scoring, the top ten risk items that occurred in the projects comprise five technical complexity, one planning and control, two system requirement, one user, and one team dimensions. The five technical complexity risks occupy the top five ranks, which shows that it is a highly significant issue in Ethiopian software project management. This is contrary to the findings in the South African, Nigerian, Canadian, Hongkonger, Finnish, and American studies. Technical complexity was not among the top ten risks in these studies, except a mention of one risk item in the Nigerian study, 'import of foreign packages' (Addison & Vallabh 2002:134; Mursu et al. 2003:186; Paré et al. 2008:7; Schmidt et al. 2001:21). This demonstrates uniqueness in the risk characteristics of the Ethiopian software projects compared to the six countries.

The findings show some similarity with the Addison and Vallabh (2002:134). The 6th and 7th ranked risk items, 'inadequately estimated schedule' and 'continually changing system requirements' were given the same rank in the South African study. 'Unrealistic schedule and budget' was also identified to be among the most important risks in the Finnish software projects (Schmidt et al. 2001:21). As seen in Paré et al. (2008:7), the last item in the top ten risks of this study, 'frequent turnover within the project team', was also in the list of most important risks in Canada.

The findings of this study also shows difference from the studies in the six countries that, 'lack of senior management commitment' and 'misunderstanding the requirements' were not identified among the top ten risks, whereas these two items were picked as the most important risks by five countries (Addison & Vallabh 2002:134; Mursu et al. 2003:186; Paré et al. 2008:7; Schmidt et al. 2001:21). Moreover, no organisational environment risks were ranked in the top ten risks.

TABLE 4.14: SUMMARY OF RISK OCCURRENCE RANKING SORTED BY MEAN VALUE (N=45)

RANK	RISK ITEM	DIMENSION	MEAN
1	The project involved use of new technology	TC	3.93
2	The project was one of the largest projects attempted by the organisation	TC	3.87
3	The task being automated was highly complex	TC	3.56
4	The project involved use of technology that has not been used in prior projects	TC	3.47
5	High level of technical complexity	TC	3.44
6	Project schedule was inadequately estimated	P&C	3.18
7	The system requirements were continually changing	SR	3.16
8	Users lacked understanding of system capabilities and limitations	SR	3.13
9	Users demonstrated resistance to change	U	3
10	There was frequent turnover within the project team	T	2.98
11	Users did not participate at the required level	U	2.96
12	Team members lacked specialized skills required by the project	T	2.89
13	Team members were not familiar enough with the tasks being automated	T	2.87
14	The development team members were not adequately trained	T	2.8
15	Users were not committed enough to the project	U	2.8
16	The required resources were inadequately estimated	P&C	2.78
17	The development team members were not well experienced	T	2.73
18	The project success criteria were not defined	SR	2.73
19	The communication among the project stakeholders was ineffective	P&C	2.73
20	Many external suppliers were involved in the development project	TC	2.64
21	Users did not cooperate well in the project implementation	U	2.62
22	There were frequent conflicts between development team members	T	2.6
23	The project required large number of links to other systems	TC	2.6
24	The organisation has undergone restructuring during the project	OE	2.56
25	The project management methodology was ineffective	P&C	2.56
26	The project planning was ineffective	P&C	2.56
27	The development team members demonstrated lack of commitment to the pro	T	2.53
28	The system requirements were not adequately identified	SR	2.49
29	Conflicts were demonstrated among users	U	2.49
30	There was change in organisational management during the project	OE	2.47
31	Project progress was not monitored closely enough	P&C	2.47
32	Project milestones were not clearly defined	P&C	2.44
33	Corporate politics has negatively affected the project	OE	2.4
34	The inputs and outputs of the system were not defined clearly	SR	2.36
35	There was no adequate top management support for the project	OE	2.29
36	Users had negative attitudes towards the project	U	2.2
37	The organisational environment was unstable	OE	2.18
38	The project involved use of immature technology	TC	2.16
39	The system requirements were unclear	SR	2.13
40	The system requirements were incorrectly defined	SR	2.11
41	The system requirements were conflicting	SR	2.04
42	Resources were shifted away from the project because of changes in organisational priorities	OE	1.93

4.3.7 RELATIONSHIP BETWEEN FORMAL RISK MANAGEMENT AND PROJECT SUCCESS

The results of this research showed that 10.5% of projects succeeded where no formal risk management was undertaken. The ratio did not produce a significant difference where organisations applied formal procedures. The proportion of projects that succeeded in the presence of formal risk management amounts to 14.3%.

TABLE 4.15: CROSSTABULATION OF FORMAL RISK MANAGEMENT VERSUS PROJECT SUCCEES (N=45)

			PROJECT SUCCEEDED		TOTAL
			NO	YES	
Formal Risk Management	No	Count	34	4	38
		% within Formal Risk Management	89.5%	10.5%	100.0%
		% within Project succeeded	85.0%	80.0%	84.4%
	Yes	Count	6	1	7
		% within Formal Risk Management	85.7%	14.3%	100.0%
		% within Project succeeded	15.0%	20.0%	15.6%
Total		**Count**	**40**	**5**	**45**
		% within Formal Risk Management	**88.9%**	**11.1%**	**100.0%**
		% within Project succeeded	**100.0%**	**100.0%**	**100.0%**

A Fisher's exact test produced a statistically non-significant relationship with a p value of 1.000 between formal risk management and project success. The null hypothesis

(H05), therefore, could not be refuted, and it was not possible to conclude that formal risk management affects project success. The relationship between formal risk management and project success is illustrated in Table 4.16 and Figure 4.5 below.

TABLE 4.16: FISHER'S EXACT TEST OF THE RELATION BETWEEN FORMAL RISK MANAGEMENT AND PROJECT SUCCESS (N=45)

	VALUE	DF	ASYMP. SIG. (2-SIDED)	EXACT SIG. (2-SIDED)	EXACT SIG. (1-SIDED)
Pearson Chi-Square	.085[a]	1	.771		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.080	1	.778		
Fisher's Exact Test				1.000	.589
N of Valid Cases	45				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .78.

b. Computed only for a 2x2 table

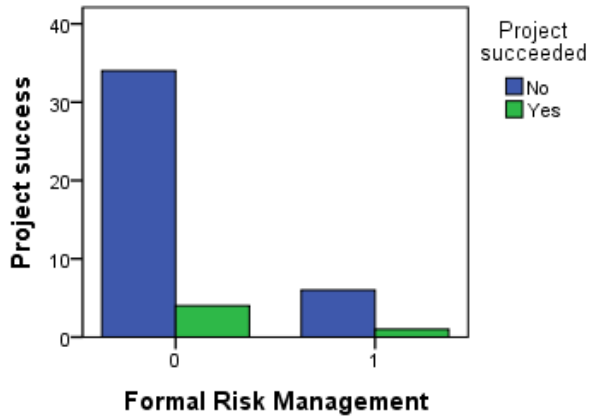

FIGURE 4.5: RELATIONSHIP BETWEEN FORMAL RISK MANAGEMENT AND PROJECT SUCCESS

4.3.8 RELATIONSHIP BETWEEN RISK MANAGEMENT PRACTICE AND PROJECT SUCCESS

Cross tabulation of risk management practice versus project success (illustrated in Table 4.17 below) shows that 4.2% of projects that succeeded were in organisations where there was no risk management practice while the rate of project success where there was risk management practice was 19%.

TABLE 4.17: CROSS TABULATION OF RISK MANAGEMENT PRACTICE VERSUS PROJECT SUCCEES (N=45)

			PROJECT SUCCEEDED		TOTAL
			NO	YES	
RM Practiced	No	Count	23	1	24
		% within RM Practiced	95.8%	4.2%	100.0%
		% within Project succeeded	57.5%	20.0%	53.3%
	Yes	Count	17	4	21
		% within RM Practiced	81.0%	19.0%	100.0%
		% within Project succeeded	42.5%	80.0%	46.7%
Total		**Count**	**40**	**5**	**45**
		% within RM Practiced	**88.9%**	**11.1%**	**100.0%**
		% within Project succeeded	**100.0%**	**100.0%**	**100.0%**

The relationship between presence of risk management and project success was investigated by applying Fisher's exact test to the finding. The test produced a p value of 0.169, which is not statistically significant. It cannot, therefore, be concluded that

presence of risk management has influenced success of the projects. H06 was not, therefore, rejected.

TABLE 4.18: FISHER'S EXACT TEST OF THE RELATION BETWEEN FORMAL RISK MANAGEMENT AND PROJECT SUCCESS (N=45)

	VALUE	DF	ASYMP. SIG. (2-SIDED)	EXACT SIG. (2-SIDED)	EXACT SIG. (1-SIDED)
Pearson Chi-Square	2.511[a]	1	.113		
Continuity Correction[b]	1.230	1	.267		
Likelihood Ratio	2.631	1	.105		
Fisher's Exact Test				.169	.134
N of Valid Cases	45				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.33.

b. Computed only for a 2x2 table

A similar result was found in Nasir and Sahibuddin (2011:2182), where risk management was found to be the 18th factor, out of 30, affecting project success. The result of the Nasir and Sahibudding study was a statistically non-significant relationship (p=0.795). It is also agreement with Harvett (2013:139) which has found a moderate positive correlation with p=0.299. However, this result is contrary to the findings of Wet and Visser (2013:25) in the South African study which has found a statistically significant relationship between risk management and project success with a p value of 0.0258.

Fig 4.6 below illustrates the above-stated relationship with a graphical presentation.

FIGURE 4.6: RELATIONSHIP BETWEEN FORMAL RISK MANAGEMENT AND PROJECT SUCCESS

The above illustration shows that the success rate of the projects was, in general, very low. A total of five out of 45 (11%) projects have succeeded. Further, project success was observed to have a statistically insignificant relationship both with application of formal risk management and presence of risk management.

4.4 CONCLUSION

This chapter has deliberated on the findings of the survey for this dissertation. Forty five project managers in banks, insurance companies and UN agencies have participated in the survey. The findings showed a very low success rate of projects. Five out of 45 were completed on time, within budget and meeting all or a majority of the initial specifications. Practice of formal risk management was also found to be low. Formal risk management was applied in only 16% of the organisations. Risk management practice level, however, was fairly high. The finding shows that 67%

exercised risk management by undertaking one or more steps of the risk management process. Of these, 42% conducted risk identification, 35% proceeded with analysis, and 38% put a mitigation or response plan in place, and 51% performed risk control and monitoring. Though the overall level of risk management practice by carrying out one or more of the steps was fairly high, the proportion of organisations that undertook all the steps in the risk management process was very low, with a value of 27%.

The scoring of risk occurrence indicated that the highest occurring risk dimension in the projects was technical complexity. Five out of top ten risks identified by the project managers were in the technical complexity dimension, the top most being 'involvement of use of new technology'. The types of risks scored as the least occurring were system requirement and organisational environment risks.

The study found out that 11% of the projects were completed on time, within budget and meeting all or a majority of the specifications. A Fisher's exact test to see the relationship between formal risk management and project success resulted in a statistically non-significant value. Similarly, the relationship test between risk management practice and project success was found to be statistically non-significant.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter is the last and concluding part of this research. It aims to present the summary and interpretation of the study findings in relation to the research objectives and questions. The conclusions drawn and recommendations made based on the findings are also presented. It also discusses the limitations of the study.

5.2 RESEARCH OBJECTIVES AND QUESTIONS

Ethiopia is among the fastest growing counties in Africa. The country has put Information and Communication Technology as one of the strategic priorities in its growth and transformation plan (Ethiopia, Ministry of Communication and Information Technology 2009:1). Many organisations are implementing information system projects at different levels. For example, all banks and insurance companies in the country are required to establish a sound information management system to acquire a banking or insurance license *(*Ethiopia, House of Peoples' Representatives 2008:4207; Ethiopia, House of Peoples' Representatives 2012:6472*).* However, even though there is no document on the success and failure rate of projects, it is apparent that not all projects succeed. The investigator, while working as a software developer, has witnessed failed projects.

Research shows that risk is one of the factors that can affect the success of projects. The effect of software risk can be controlled with an effective risk management system (Bannerman 2008:2118-2119; Bhatia & Kapor 2011; Kwak & Stoddard 2004:916; López & Salmeron 2012b:438; Royer 2000:6). This study aimed to investigate the formal or informal risk management practice in Ethiopian software projects and the steps included in the informal risk management process, to examine the relationship between project success and risk management practice, and to explore the major risk factors faced by Ethiopian software projects.

The study was conducted with the following objectives:

- assess whether formal risk management techniques are applied in the software projects
- investigate whether risk management is practiced in the software projects
- examine whether organisations conduct all the risk identification, analysis, mitigation or response, and monitoring and control steps
- explore the top ten risk factors faced by Ethiopian software projects;
- investigate if project success is affected by formal risk management practice
- explore if project success is affected by risk management practice

In line with these objectives, a wide range of resources in the topic were studied and six null hypotheses were established based on the findings from the literature:

H01: Formal risk management procedures are not applied in the Ethiopian software projects.

H02: Risk management procedures are not exercised in the Ethiopian software projects.

H03: Organisations undertaking risk management do not include all the identification, analysis, mitigation, response, monitoring and control steps

H04: Software project risks faced by organisations in Ethiopia are the same as those in the developed world.

H05: Application of formal risk management does not influence success of Ethiopian software projects.

H06: Risk management practice does not influence success of Ethiopian software projects

The findings of the study are presented below with reference to the research objectives and suggested hypotheses.

5.3 APPLICATION OF FORMAL RISK MANAGEMENT MODELS

Formal risk management was not applied by more than 16% of the organisations under study. The majority of these (11.1%) used the IEEE framework. Boehm's framework was employed by 6.7%. One organisation adopted the Riskit model. This indicates a very low level of application of formal risk management in the projects. Because the finding (16%) was a much lower proportion than the hypothetical mean (50%), no further test was conducted to check the statistical significance. Therefore, the null hypothesis H01 could not be refuted and it was not possible to conclude that formal risk management models are applied in the Ethiopian software projects.

Though this finding is in consistency with other studies such as the South African study by Wet and Visser (2013:23-26) and the Nigerian study by Adeleye et al. (2004:176),

adoption of documented risk management models could be beneficial for countries like Ethiopia, where Information and Communication Technology is in its initial stages of development, because such models provide well developed steps with assigned responsibility and detailed description of phases.

5.4 PRACTICE OF RISK MANAGEMENT

According to the findings of this study, 67% of the organisations practice risk management by carrying out one or more phases of the process. A one-sample T-Test showed a statistical significance of the finding and H02 was rejected leading to the conclusion that risk management is practiced in Ethiopian software projects. This finding agrees with the Australian result in Bannerman (2008:2124) which shows that 71% practiced formal, semi-formal or informal risk management. This result is higher compared to the South African study which found out that only 40% undertook one or more of the steps identified by the IEEE model.

5.5 RISK MANAGEMENT STEPS UNDERTAKEN BY ORGANISATIONS

Risk identification was conducted by 42% of the organisations, of which, only 33% undertook risk analysis and prioritization. A mitigation or response plan was put in place by 38%. More than half of the participants indicated that they performed risk control and monitoring. This indicates that though organisations do not carry out risk identification, they monitor the projects to keep themselves aware of arising risks. The proportion of organisations that performed all the phases of the risk management process was found to be 27%. No test was conducted to test the statistical significance

of the finding since the sampled mean (27%) was much less than the target mean (50%). The null hypothesis H03, which suggests that organisations do not include all steps of the risk management process, could not be rejected. This is a very low result compared with the Australian study. Bannerman (2008:2124) found that 71% of the organisations carried out all the phases of the process.

This could also be an indication to a need for improvement, because following only part of the phases may not bring about the desired result in enabling the project managers to control risks that occur in software projects.

5.6 THE MAJOR RISK FACTORS ETHIOPIAN SOFTWARE PROJECTS FACE

Respondents' score of risk items showed that a majority of the projects faced technical complexity risks. The average mean scores for risks in the team, organisational environment, project system requirement, project plan and control, users and technology complexity dimensions were 2.77, 2.31, 2.52, 2.67, 2.68 and 3.21, respectively. This demonstrates that projects faced all the risks identified by Wallace, et al. (2004:122-123). However, the major challenges the projects faced stemmed from technology complexity risks. This may be due to the fact that Information and Communication Technology is in its early stages of development in the country.

The finding is contrary with the top ten risks identified by the South African, Nigerian, Canadian, Hongkonger, Finnish, and American studies (Addison & Vallabh 2002:134; Mursu et al. 2003:186; Paré et al. 2008:7; Schmidt et al. 2001:21). The risk dimensions that occurred most in these studies were system requirement and project planning and control. This shows that the software project risks Ethiopian organisations face are different from those identified by the literature, resulting in rejection of the null hypothesis H04.

5.7 IS THE SUCCESS OF ETHIOPIAN SOFTWARE PROJECTS AFFECTED BY THE APPLICATION OF FORMAL RISK MANAGEMENT STANDARDS?

A Fisher's exact test between application of formal risk management and project success resulted in a statistically non-significant relationship. The result supports the null hypothesis H05 which suggests that application of formal risk management does not influence success of software projects. It could thus not be concluded that formal risk management practice affected the Ethiopian software project success.

5.8 IS THE SUCCESS OF ETHIOPIAN SOFTWARE PROJECTS AFFECTED BY THE RISK MANAGEMENT PRACTICE?

In a similar fashion, a Fisher's exact test was conducted to check the relationship between risk management practice and project success and it resulted in a p value of 0.169. Therefore, no significant relationship was observed between risk management practice and project success and the null hypothesis H06 could not be rejected.

5.9 RECOMMENDATIONS

The findings of this study have shown a very low level of formal risk management practice in organisations. Though the overall risk management practice was found to be fairly high (67%), the result revealed that organisations do not apply all the steps in the process. Only 27% of the total organisations were found to be undertaking all the risk

management phases. Though the study did not investigate the impact of the risk management phases on project performance, conducting partial steps may not have allowed control of risks at the required level. The literature shows that risk management not only helps prevent and control unprecedented negative impacts, but also enables project managers to maximize the probability and impact of potential opportunities (Tesch, et al. 2007:62). Without a sound risk management process, it may be difficult to control the outcome of the project by maximizing probable positive effects and also avoiding or minimizing the possible negative impacts. Based on the findings of this study, the investigator thus suggests that the Ethiopian software project risk management cannot be considered adequate and may require more emphasis and attention.

This study also indicated that a majority of the top ten risk items affecting the software projects are technical complexity risks. Though the effect of the technical complexity on the project performance was not investigated in this study, the finding may be an indication that project managers should give adequate attention to the risks in the technical complexity dimension.

5.10 CONTRIBUTION OF THE STUDY

This study sheds light on the risk management practice in the software project management process in the Ethiopian context. It was conducted on banks, insurance companies and UN agencies in Ethiopia. These institutions put a large investment in information systems and carry out numerous software projects. Though the finding does not actually show the reality on the topic in other business domains like small-scale business and government sector, it can give an insight on the risk management practice, risk factors and impact of risk management on software projects in the Ethiopian context.

5.11 FUTURE RESEARCH

This study was conducted on organisations that invest heavily in information systems. Therefore, although it provides an insight into the risk management practice of the Ethiopian software projects, it cannot be generalized to the larger group of all Ethiopian organisations. Further research can be conducted to investigate the risk management practice in other business domains in the country like government and small-scale business sectors.

The research has found that the proportion of organisations that carry out all the risk management process phases is very low. The impact of the different phases of the risk management process on the performance of projects is worth further discussion. This study has also identified the top ten risk items affecting the software projects based on participants' scoring. Technical complexity was found to be the top most risk dimension occurring in the projects. The impact of the risk items on the project performance could be an area of opportunity for further research.

5.12 CONCLUSION

This chapter has deliberated in the research findings, conclusions drawn and recommendations made with reference to the six objectives of the study. The study demonstrates low level of formal risk management practice. A fairly high level of risk management practice was observed from the finding that organisations conduct one or more steps of the process. However, a low proportion of organisations conduct all the steps. A majority of the projects faced technical complexity risks. Neither application of formal risk management nor risk management practice was found to have a statistically significant relationship with project success.

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APPENDICES

APPENDIX 1 - ETHICAL CLEARANCE

UNISA | college of science, engineering and technology

Dear Mrs Mihret Abeselom Teklemariam (46340564)

Date: 2015-02-25

Application number:
015/MAT/2015

REQUEST FOR ETHICAL CLEARANCE: (Software Project Risk Management Practice in Ethiopia)

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your research study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CRIC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:
http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that the ethical clearance is granted for the duration of this project and if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Prof Ernest Mnkandla
Chair: College of Science, Engineering and Technology Ethics Sub-Committee

Prof OG Moche
Executive Dean: College of Science, Engineering and Technology

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APPENDIX 2 - QUESTIONNAIRE

I. GENERAL

1. Full name (optional) _____

2. Name of your organisation (optional) _____

3. Your organisation type: *
   - A bank
   - An insurance company
   - A UN Organisation

4. What is the size of your organisation?
   - Under 10 employees
   - 10 – 50 employees
   - 50 – 100 employees
   - 100 – 500 employees
   - Above 500 employees

II. PROJECT PROFILE

Please choose one of the Information Systems projects that have been undertaken in your organisation and complete the following questions with the information.

5. Project title _____

6. Please select the project type: *
   - New software development
   - Off-the-shelf software customization
   - Upgrade of an existing software system

7. Project implementation type *
   - In-house developed
   - Outsourced to a local vendor
   - Outsourced to an international vendor
   - Outsourced to a joint local and international vendors

8. What was the total budget planned for the project?
    - <100,000 ETB
    - 100,000 – 500,0000 ETB
    - 500,001 – 1,000,000 ETB
    - >1,000,000 ETB
    - No specific budget was planned
    - I don’t know

III. PROJECT COMPLETION

9. Which of the following is true about the project schedule? *
    - It has been going on ahead of schedule
    - It has been going on as per the planned schedule
    - There has been a delay in the project schedule
    - I don't know

10. Which of the following is true about the project budget?*
    - It has taken lesser budget than estimated
    - It has taken the same budget as estimated
    - It has taken more budget than estimated
    - I don't know

11. At completion, to what extent has the project met the specification? *
    - Fully
    - In majority
    - Average
    - Not really
    - Not at all
    - I don't know

IV. RISK MANAGEMENT

i. RISK MANAGEMENT - Formal models

12. Different formal models are available for risk management. Organisations can apply one or more of existing formal risk management methodologies or they can design their own framework. Below are listed few of widely used formal risk management models. Please indicate which formal risk management models were applied in your organisation.
    - o Boehm's Risk Management Model
    - o IEEE Risk Management Model
    - o Riskit Risk Management Model
    - o CMMI Risk Management Model
    - o No formal Risk Management model was applied
    - o Other: _____

ii. RISK MANAGEMENT - Risk Identification

13. Does your organisation have a risk register?
    - o Yes
    - o No
    - o I don't know
14. Was risk identification carried out at the commencement of the project? *
    - o Yes
    - o No *(Please skip to question no. 21)*
    - o I don't know *(Please skip to question no. 21)*

15. Which of the following methods were used in risk identification process?
    - ☐ Using checklist
    - ☐ Interviews
    - ☐ Team meetings
    - ☐ Other: _____

16. Who participated in the risk identification process?
    - ☐ Top management members
    - ☐ Project Manager
    - ☐ The project team members
    - ☐ End users
    - ☐ Third party consultants
    - ☐ Other: _____

17. Was risk response or mitigation plan determined for the identified risks?
    - o Yes
    - o No
    - o I don't know
18. Were the identified risks prioritized? *
    - o Yes
    - o No *(Please skip to question no. 21)*
    - o I don't know *(Please skip to question no. 21)*

iii. RISK MANAGEMENT - Risk Prioritization

19. How was the risk prioritization done?
    - ☐ Based on likelihood of occurrence
    - ☐ Based on magnitude of impact
    - ☐ Other:_____

20. Who participated in the risk prioritization process?
    - ☐ Top management members
    - ☐ Project Manager
    - ☐ The project team members
    - ☐ End users
    - ☐ Third party consultants
    - ☐ Other:_____

iv. RISK MANAGEMENT - Risk Mitigation and Response

21. Was risk response or mitigation plan determined when risks occurred?
    - o Yes
    - o No
    - o I don't know

v. RISK MANAGEMENT - Risk Control and Monitoring

22. Was risk monitoring and control plan determined when risks occurred?
    - o Yes
    - o No
    - o I don't know

V. PROJECT RISK

The following are common project risks identified by project managers around the world. Please indicate the extent to which the risk factors have happened in your project.

i. PROJECT RISK – Project Team

23. Which of the following apply to the project team involved in the project implementation? *

	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
There was frequent turnover within the project team	☐	☐	☐	☐	☐
Team members were not familiar enough with the tasks being automated	☐	☐	☐	☐	☐
Team members lacked specialized skills required by the	☐	☐	☐	☐	☐
The development team members were not adequately trained	☐	☐	☐	☐	☐
The development team members demonstrated lack of commitment to the project	☐	☐	☐	☐	☐
The development team members were not well experienced	☐	☐	☐	☐	☐
There were frequent conflicts between development team members	☐	☐	☐	☐	☐

ii. PROJECT RISK – Organisational Factors

24. Which of the following organisational factors apply to your project? *

	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
There was no adequate top management support for the project	☐	☐	☐	☐	☐
There was change in organisational management during the project implementation	☐	☐	☐	☐	☐
The organisation has undergone restructuring during the project implementation	☐	☐	☐	☐	☐
The organisational environment was unstable	☐	☐	☐	☐	☐
Corporate politics has negatively affected the project	☐	☐	☐	☐	☐
Resources was shifted away from the project because of changes in organisational priorities	☐	☐	☐	☐	☐

iii. PROJECT RISK – Project System Requirement

25. Please indicate which of the following with the project's system requirement. *

	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
The project success criteria were not defined	☐	☐	☐	☐	☐
The system requirements were not adequately identified	☐	☐	☐	☐	☐
The system requirements were incorrectly defined	☐	☐	☐	☐	☐
The system requirements were unclear	☐	☐	☐	☐	☐
The system requirements were conflicting	☐	☐	☐	☐	☐
The system requirements were continually changing	☐	☐	☐	☐	☐
The inputs and outputs of the system were not defined clearly	☐	☐	☐	☐	☐
Users lacked understanding of system capabilities and limitations	☐	☐	☐	☐	☐

iv. PROJECT RISK – Project Planning and Control

26. Which of the following apply to the planning and control of the project? *

	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
Project milestones were not clearly defined	☐	☐	☐	☐	☐
Project progress was not monitored closely enough	☐	☐	☐	☐	☐
The project management methodology was ineffective	☐	☐	☐	☐	☐
The project planning was ineffective	☐	☐	☐	☐	☐
The communication among the project stakeholders was ineffective	☐	☐	☐	☐	☐
The required resources were inadequately estimated	☐	☐	☐	☐	☐
Project schedule was inadequately estimated	☐	☐	☐	☐	☐

v. PROJECT RISK – Users

27. Which of the following describe users' involvement in the project? *

Users:	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
did not cooperate well in the project implementation	☐	☐	☐	☐	☐
demonstrated resistance to change	☐	☐	☐	☐	☐
were not committed enough to the project	☐	☐	☐	☐	☐
Did not participate at the required level	☐	☐	☐	☐	☐
Had negative attitudes towards the project	☐	☐	☐	☐	☐
Did not understand the system capabilities and limitations very well	☐	☐	☐	☐	☐
Some conflicts were demonstrated among users	☐	☐	☐	☐	☐

vi. PROJECT RISK – Technical Complexity

28. Please indicate which of the following describe the level of technical complexity of the project. *

	Strongly agree	Moderately agree	Neutral	Moderately disagree	Strongly disagree
The project involved use of technology that has not been used in prior projects	☐	☐	☐	☐	☐
The project involved use of new technology	☐	☐	☐	☐	☐
The project involved use of immature technology	☐	☐	☐	☐	☐
The project required large number of links to other systems	☐	☐	☐	☐	☐
High level of technical complexity	☐	☐	☐	☐	☐
The project was one of the largest projects attempted by the organisation	☐	☐	☐	☐	☐
Many external suppliers were involved in the development project	☐	☐	☐	☐	☐
The task being automated was highly complex	☐	☐	☐	☐	☐