PROJECT MANAGEMENT APPLICATION IN ACADEMIC AND RESEARCH INSTITUTIONS IN ZAMBIA

By

INNOCENT MANDONA

A dissertation submitted to the University of Zambia in partial fulfilment of the requirements of the degree of Master of Engineering in Project Management

THE UNIVERSITY OF ZAMBIA

LUSAKA

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DECLARATION

I, **Innocent Mandona** do declare that this dissertation is entirely my own work except as specified in the acknowledgements and that neither the dissertation nor the original work contained herein has been submitted to this or any other institution for a higher degree.

Signed:……………………………………………….

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CERTIFICATE OF APPROVAL

This dissertation of Innocent Mandona has been approved as fulfilling the requirements for the award of the degree of Master of Engineering in Project Management by the University of Zambia.

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ABSTRACT

Research and development needs effective and efficient management as it is the vehicle by which organizations and economies create opportunity, innovation and secure a stream of future products and services. However, research projects face various challenges which may lead to unsatisfactory performance. Various studies have shown that traditional project management methods can be adapted for research projects to make work more efficient and productive. For Zambia, it was not clear to what extent the research institutions in the country implemented project management techniques in managing research projects. Therefore, this study sought to determine whether academic and research institutions in Zambia were using project management techniques in managing research projects. The study adopted a descriptive research design and used a mix of both qualitative and quantitative techniques. The results obtained showed that the majority of academic and research institutions in Zambia applied project management techniques in managing research. Additionally, the study revealed that the majority of the respondents had identified weaknesses in the research management frameworks in their respective institutions. Therefore, in order to improve performance of research projects, this study recommended the need to develop a national research agenda for Zambia, to further enhance the respective institutional research management guidelines or policies, to enhance project management skills of researchers in academic and research institutions, to improve the monitoring and evaluation frameworks in these institutions as well as to offer consistent and adequate funding to support research.

Keywords: Research project, research organisation, innovation, project management, monitoring and evaluation

DEDICATION

I dedicate this work to my daughter Chileshe and my wife Kangwa. Thank you for the understanding, encouragement and support.

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My sincere appreciations go to everyone that supported me during the course of studies.

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Lastly, I acknowledge the support of my family during the study.

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LIST OF ABBREVIATIONS

ANSI - American National Standard Institute

CBU - Copperbelt University

CIDRZ - Centre for Infectious Disease Research in Zambia

CVRI - Central Veterinary Research Institute

IAPRI - Indaba Agricultural Policy Research Institute

IEEE - Institute of Electrical and Electronics Engineers

IP – Intellectual Property

KA – Knowledge Area

KPI – Key Performance Indicator

M&E – Monitoring and Evaluation

NISIR – National Institute for Industrial and Scientific Research

NSTC – National Science and Technology Council

PMBOK - Project Management Body of Knowledge

PMO – Project Management Office

PMI – Project Management Institute

R&D – Research and Development

SPGRC - SADC Plant Genetic Resources Centre

SRA – Society for Research Administrators

TDRC – Tropical Diseases Research Centre

UNZA – University of Zambia

ZAM - Zambia Association of Manufacturers

ZAMRA - Zambia Medicines Regulatory Agency

ZARI – Zambia Agricultural Research Institute

ZIPAR - Zambia Institute for Policy Analysis and Research

CHAPTER ONE: INTRODUCTION

1.1   Background

Research and development (R&D) is the vehicle by which organizations and economies create opportunity, innovation and secure a stream of future products and services (Basu, 2015). Research and development, therefore requires effective and efficient management. Endogenous growth theory assumes that an economy automatically benefits from its investments in new knowledge (Lucas 1988; Romer 1990) because knowledge is a public good that can be used by an entire economy, leading to innovation and economic growth (Cantner et al. 2008).

However, successful project execution is affected by numerous constraints that limit the commencement or progression of work activities, which invariably have significant negative impact on overall project performance (Larson and Gray, 2018). These constraints do have the potential to prevent a project from achieving its goals. Therefore, it becomes imperative that for the successful execution and control of a project, effective constraint identification and management, through master planning and short-term look-ahead scheduling is well defined. While a master plan or schedule provides a global view of a project and the overall execution strategy, a look-ahead schedule offers a detailed account of operational constraints and a detailed plan showing work to be done within a relatively short time window. Further, it is important to recognize that the defined project schedule or plan should be monitored to ensure that project implementation is on track. The monitoring of project performance also gives an indication of how well the project management system employed by the project team is performing. Research activities being projects in their nature, would benefit from a system with the foregoing attribute only available where project management techniques are adopted.

As already highlighted, the challenge faced by researchers is the fundamental unpredictability of research which is why effective project management is so important when undertaking research (Basu, 2015). The unpredictability of research could arise from lack of clearly defined research goals coupled with unexpected results which may alter the course of action at any given time. However, traditional project management methods can be adapted for research projects to make work more efficient and productive by: defining deadline-driven project deliverables and

milestones; performance measures to evaluate progress; and the resources needed to get there (Donna, 2017). The adaption of project management methods to research projects means that the triple constraints of time, cost, and scope must be fulfilled whist ensuring quality.

The Project Management Institute (2017) defines project management as the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. Project management ultimately has three functions; planning, executing and controlling. Project management mostly has a unique focus shaped by the goals, resources and schedule of what is to be achieved. Considering that most organisations face the daunting task of executing projects that meet or exceed the expectations of their customers, project management becomes a key component for these enterprises, regardless of the business sector. With the stated importance associated with project management, it has been noted that project management is not always met with organization-wide satisfaction. This may be attributed to the fact that many project management offices (PMOs) are replicated and not designed for particular organisations. Inevitably many PMO processes are little more than copies of what other companies have implemented (Eby, 2017). They lack a root-level connection to the company they support.

Given the above, it can be stated that a project management system may face different types of challenges during project implementation which may result in low performance. According to University of Villanova (2018) there are ten challenges that a project management system can encounter, that include:

i. **Undefined Goals** – This happens when goals are not clearly identified. Establishing and communicating clear goals from the onset of the project becomes important;

ii. **Scope Changes** – Issues arise when changes to the project scope are not properly managed. The implications of scope changes on the budget ought to be effectively communicated to all stakeholders;

iii. **Inadequate Skills for the Project** – A project sometimes requires skills that the project contributors do not possess. The system has to determine the needed competencies, assess the available workers and recommend training, outsourcing or hiring additional staff;

iv. **Lack of Accountability** – This can happen when project members do not take responsibility for their roles in achieving project success;

v. **Improper Risk Management** – Given that projects rarely go exactly to plan, the project management team needs to put in place a system that gathers information/input, assess, identify and categorize components of a project which are most likely to veer off course;

vi. **Ambiguous Contingency Plans** – If contingencies are not identified, the entire project can become mired in an unexpected set of problems;

vii. **Poor Communication** – Lack of effective communication with everyone involved in the project usually brings problems in project execution. What may be cardinal is to keep communication and feedback flowing among stakeholders;

viii. **Impossible Deadlines** – When unrealistic and unattainable deadlines are set, the project would be judged to have failed and the related consequences of low morale and productivity follow;

ix. **Resource Deprivation** – In order for a project to be run efficiently and effectively, sufficient resources should be provided; and

x. **Lack of Stakeholder Engagement** – Effective stakeholder updates and feedback usually results in project success.

The above discussion gives sufficient confirmation that projects do face a certain amount of uncertainty, and that this could be attributed to a number of reasons. It is imperative, therefore, that in the process of measuring project management performance when managing research projects, clear benchmarks are defined, such as key performance indicators (KPIs). KPIs in project management consist of various specific measurement tools for indicating how well teams are achieving specific goals and these are generally agreed upon in the early stages of the project. The KPIs reflect the organization's central concept of the project and solidify project responsibility across administrative divisions. In as much as project performance and success is not always easy to measure, harnessing the power of a strong key performance indicator strategy can help lead to successful projects (Ibid).

With the stated challenges faced when implementing research projects, and the proposed adaptation of project management techniques to enhancing the effectiveness of research and development activities as discussed by (Basu, 2015), research management becomes important. Research management involves harnessing the capabilities that research-focused institutions poses and optimsing the application the various processes of their research activities and

outcomes (Southern African Research and Innovation Management Association, 2018). Research management is recognised across the world to be a highly diverse and a mixture of responsibilities (Drennan, 2018). Research management in the Southern African region is evolving into its own profession with an established body of knowledge, set of principles, linked associations, formal qualifications, and human resources descriptions and specifications (Schwab, 2017). Drennan (2018) further stated that contexts in the Southern African region for research management, however, are highly diverse, unequal, have varied infrastructures and are differently resourced. Research management is therefore practiced inconsistently and may even be defined differently, dependent on the individual, institution, structure and system with some institutions fully adopting the project management techniques (ibid). With the foregoing, it becomes necessary to understand the Zambian situation on aspects of research management. The study, therefore, riding on the government's aspirations as enshrined the Seventh National Development Plan (7NDP) of enhancing the effectiveness of research and development in the country, directed efforts to understand whether, academic and research institutions were using project management techniques in research management.

1.2   Statement of the problem

As countries transition from resource based to knowledge based economies, research and development (R&D) has received much attention in the development agenda (Roberts, 2009). Accordingly, the Seventh National Development Plan (7NDP) for Zambia has prioritized research and development (R&D). Research and development therefore, is expected to play a critical role in the innovation and development processes in the country, through diversification and exploring opportunities that will enhance the productive capacities of the various sectors of the economy (Ministry of National Development Planning, 2017). It is with this same vision that as far back as 1996, the government reorganized the 1970 science and technology - institutional and legal framework which resulted in the 1996 National Policy on Science and Technology. However, during implementation of the 1996 National Policy on Science and Technology, various challenges affecting the advancement of science, technology and innovation (STI) were revealed. Some of the challenges identified relate to human capital, research infrastructure and equipment, funding to research, and quality of research and its assurance (Ministry of National Development Planning, 2017).

Further to the above, Zambia has seen little value addition to its raw materials (Zambia Association of Manufacturers Report, 2017). The National Policy on Science and Technology of 1996 suggests that, the lack of application of science and technology is a major contributing factor to the poor performance of industry and that this has resulted in industries becoming uncompetitive with declining productivity under global trade environment (Ministry of Science, Technology and Vocational Training, 1996). This lack of application of science and technology may be attributed to low levels of collaboration between academia and the private sector. Besides the lack of application of science and technology, the Seventh National Development Plan also indicated a weak innovation capacity in the country. The 7NDP has therefore, recognized the need to strengthen research capacities in academic and research institutions in order for them to conduct various research activities. The plan further proposed to develop capacities in the Zambian people to carry out research programmes with internationally accepted standards (Ministry of National Development Planning, 2017). The need for enhanced research capacity is supported by the 2018 Global Innovation Index which ranked Zambia number 120 out of 128 countries. This ranking shows that the innovation capacity in Zambia is weak. The global innovation index is an annual ranking of countries by their capacity for, and success in innovation.

To improve the effectiveness of research and development activities in the country, this research proposed adapting project management techniques in research management. The aspect of project management in R&D was also not prominent in the literature cited above. It was however, not clear to what extent research institutions in Zambia implemented project management techniques in the management of research projects to improve performance. As a result, the study attempted to determine the extent to which research institutions implement project management techniques in managing research projects, the study also proposed best practices for the effective management of research projects.

1.3 Aim
The main aim of the study was to determine whether research institutions in Zambia were using project management techniques in managing research projects.

1.4   Objectives

The aim of the research was achieved through the following objectives:

   i.   investigating the existence of frameworks for research management in academic and research institutions in Zambia;

  ii.   determining the level of project management knowledge among academicians and researchers;

 iii.   determining the main impediments to successful implementation of research projects in academic and research institutions; and

 iv.   Suggesting measures to curb the potential impediments to the successful performance of research projects in Zambia

1.5   Research questions

The study addressed the following research questions:

   i.   Where academic and research institutions in Zambia using project management techniques when managing research projects?

  ii.   Did the academic and research institutions have policies or guidelines for managing research projects?

 iii.   Where academic and research institutions monitoring research projects?

 iv.   How where research projects assessed in the various academic and research institutions?

  v.   Where academicians and researchers using any project management techniques when managing research projects?

 vi.   Which project management techniques did the academicians and researchers use in managing research projects?

 vii.   What were the challenges faced by academicians and researchers when implementing research projects?

viii.   How could research management in academic and research institutions be improved?

1.6 Significance of the study

The significance of the study is premised on the fact that the findings will contribute to the enhancement of research management in academic and research institutions in Zambia. The improved performance is expected to translate into a more confident collaboration between academia and industry. The expected collaboration between academia and industry will see increased value addition of raw materials through effectively and efficiently managed research and development. Further, adopting and adapting of project management techniques in managing research is a relatively new topic in Zambia and as such there is little documentation on recommendations of how best project management techniques can be incorporated in research management for relevant results and efficient resource utilisation. This study will contribute to literature on the application of project management techniques in academic and research institutions in Zambia.

1.7 Organization of the dissertation

The dissertation is organized in six (06) chapters as indicated in Figure 1.1. Each chapter is summarized as below:

Chapter one (01) provides the background of the research, statement of the problem, aims and objectives of the study. This serves as the introduction for the study.

Chapter two (02) covers the literature reviewed on project management and its application to managing research projects.

Chapter three (03) documents the methodology employed in conducting the study by stating the research design, sample size and target, data collection tools and techniques, and the data analysis techniques.

Chapter four (04) presents the results of the study and the analysis of data obtained through questionnaires and structured interviews.

Chapter five (05) discusses the findings and their significance thereby leading to the conclusions and recommendations directed at improving the performance in managing research projects presented in **chapter six (06).**

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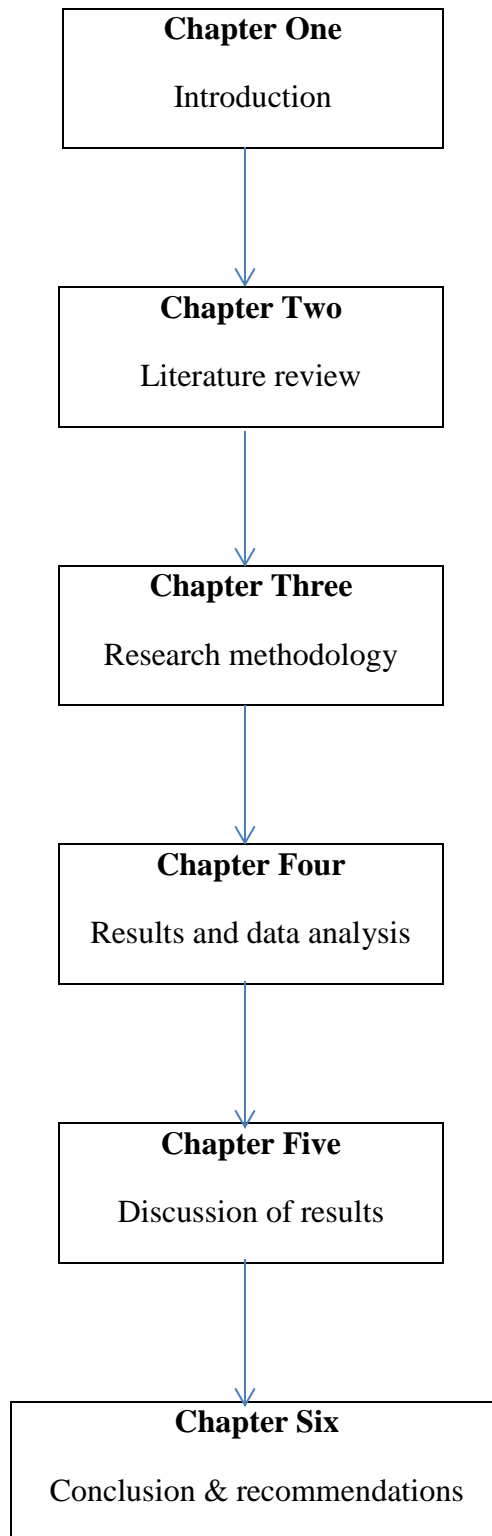
Figure 1.1 Layout of chapters

1.8   Summary

This chapter presented the introduction to the study conducted on project management application in academic and research institutions in Zambia. The chapter covered the background to project management application in managing research projects, the problem statement and further presented the objectives of the study. Finally, the chapter presented the significance of applying project management techniques in managing research projects in Zambia. Chapter 2 that follows discusses the literature reviewed in conducting the research with emphasis on learning about what other researchers have studied or done. The literature reviewed covered project management and its application to research management.

CHAPTER TWO: LITERATURE REVIEW

2.1   Introduction

The preceding chapter gave background to the importance of adapting project management techniques when implementing research projects. The chapter emphasized that adapting project management techniques by academia and research institutions would improve performance in these institutions which would result in confident collaborations between academia and industry. The chapter also outlined the objectives of the study, and concluded by giving an outline of the chapters in this report. This chapter gives an overview on project management and its adaptation to research management. The chapter also presents literature of some studies done by different scholars on the application of project management techniques in managing research projects. The chapter ends with a summary of the reviewed literature.

2.2   Definitions

The Project Management Institute (2017) gives the following definitions relating to project management:

a)   **a project** is a temporary endeavor undertaken to create a unique product, service, or result;

b)   **project management** is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements;

c)   a **project life cycle** is the series of phases that a project passes through from its start to its completion;

d)   a **project phase** is a collection of logically related project activities that culminates in the completion of one or more deliverables;

e)   **project management processes** are systematic series of activities directed toward causing an end result where one or more inputs will be acted upon to create one or more outputs;

f)   a **Project Management Process Group** is a logical grouping of project management inputs, tools and techniques, and outputs; and

g)   **a Project Management Knowledge Area** is an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques.

The Project Management Institute (2017) further presents the relationship between the core technical subject matters of projects management i.e. knowledge areas and process groups, and the generic lifecycle. This relationship is illustrated in Figure 2.1 (Project Management Institute, 2017:p18).
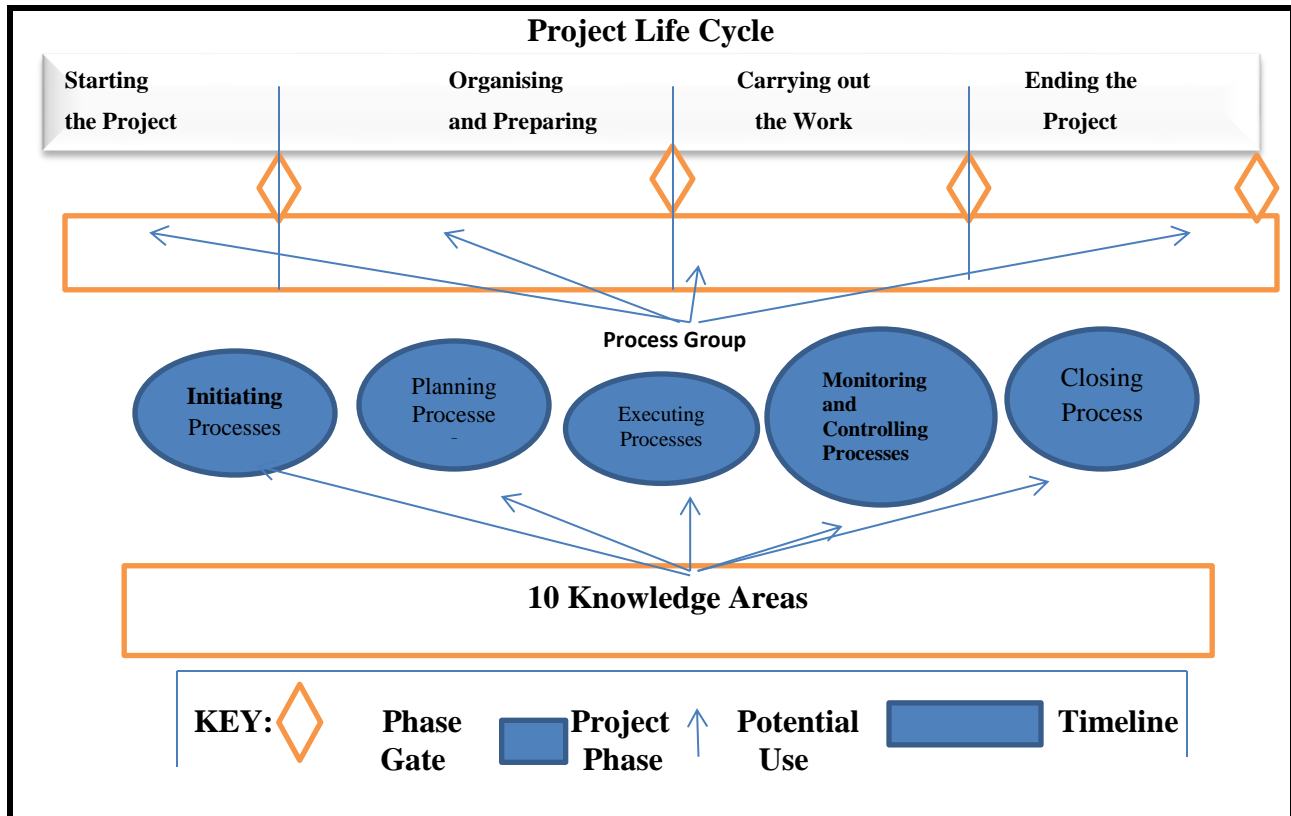
Figure 2.1: Interrelationship of project phases, knowledge areas and process groups

According to Kenton (2019) research and development (R&D) refers to the activities institutions undertake to innovate and introduce new products and services. It is often the first stage in the development process.

Banda (2018) presented the definitions of research listed below as being acceptable:

a.   the application of human intelligence in a systematic manner to a problem whose solution is not immediately known;

b.   a collection of methodologies and methods applied systematically to produce scientifically based knowledge about reality;

c.   search for knowledge in a scientific way;

d.   search for new facts in any branch of knowledge;

e.   scientific and systematic search for pertinent information on a specific topic;

f.   exciting process of discovery requiring patience, integrity, tolerance and interaction with others; an

g.   an original contribution to the existing stock of knowledge;

2.3   Organisational project management

Economic activities have transitioned in human history through various stages, from hunter and gatherer societies through the agrarian to the industrial society (Johnson, 2000). The current business environment is dynamic with changing market conditions, and consumer needs, a situation which calls for innovative ways for executing projects in organisations (Daga, 2014). Considering that changes in the business environment affect different parts of the project and the organizations based on their nature and complexity, organizational project management is implemented to manage these changes (Sopko, 2015).

Organizational Project Management (OPM) has been defined by the project management institute (2003, 2008 and 2013) as the execution of an organization's strategies through projects by combining the systems of portfolio management, program management, and project management. Organizational Project Management (OPM) therefore, provides organizations the means to improve their capabilities and performance in the delivery of a defined strategy (Bull, Shaw, and Baca, 2012). OPM, therefore, aims to ensure that the organization undertakes the right projects and allocates critical resources appropriately and helps to ensure that all levels in the institution understand the strategic vision, the initiatives that support the vision, the objectives, and the deliverables (PMI, 2018). The key challenge to organizational project management is that institutions tend to view projects in isolation by ignoring the obvious (and sometimes not-so-obvious) linkages among the past and present projects in fulling the organizational strategic objectives (Curran – Morton, 2011).

The project management institute, (2017) suggests that a project may be managed in three separate scenarios: as a stand-alone project (outside of a portfolio or program), within a program, or within a portfolio. Further, the project management institute (2017) proposes that in certain

situations where multiple and related projects may be necessary to accomplish a set of goals and objectives for an organization, these are grouped into programs and in other cases, projects, programs, subsidiary portfolios, and operations managed as a group to achieve strategic objectives would suffice and these are termed portfolios. However, program management and portfolio management differ from project management in their life cycles, activities, objectives, focus, and benefits with scope and objectives getting larger when moving from project management towards portfolio management (Usmani, 2019). Considering the relevance of project management in the organizational text, the study attempted to explore project management's significance for effective research management.

2.4   Overview of project management and its application to research management

It is possible to say that the concept of project management has been around since the beginning of history. Project management has enabled people to plan bold and massive projects and manage funding, materials and labor within a designated time frame (Barron, 2011). Projects ideally have certain characteristics that enable them of being differentiated from other endeavors and research activities subscribe to these (Larson, 2018). The major project characteristics include:

a)   an established objective and this characteristic is not typical of routine work;

b)   a defined life span with a beginning and an end which is unlike the ongoing duties and responsibilities of traditional jobs;

c)   it usually involve several departments and expertise;

d)   performing tasks that have never been done before; and

e)   specific time, cost, and performance requirements (Ibid).

From the last characteristic of projects, it is fitting to say that at the core of project management is the balancing act among the triple constraints of time, funding, and scope, while ensuring high quality and performance. These triple constraints impose a higher degree of accountability than typically found in most jobs. The three also highlight one of the primary functions of project management, which is balancing the trade-offs among time, cost, and performance while ultimately satisfying the customer (Ibid). Figure 2.2 portrays this relationship. While time is usually the limiting factor in industry, the uncertain funding environment in academic and

research institutions, may constrain projects more (Donna, 2017). Additionally, the products of basic research are more variable. Implementing project management techniques in research management means allocating, using, and tracking resources to achieve a goal in a desired time frame.
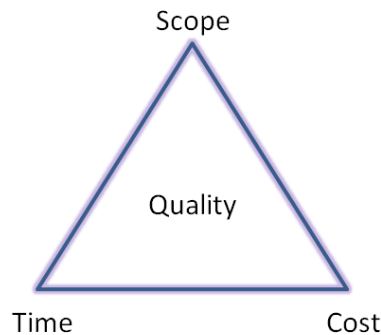
Figure 2.2   Project management triple constraints

In a research setting, goals may include publishing a paper, obtaining a research grant, completing a set of experiments, or even achieving tenure. However, in several instances, which may be attributed to insufficient knowledge in project management practices in research management, the triple constraints of time, funding and scope are often ignored leading to uncertainty in the quality and performance of the research projects (Ibid).

2.5   Project life cycle

According to Barron (2011) every project has a beginning, a middle period during which activities move the project toward completion, and an ending (either successful or unsuccessful). A standard project typically has the following four major phases (each with its own agenda of tasks and issues): initiation, planning, execution, and closure. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project life cycle. Larson (2018) further states that, "one way of illustrating the unique nature of project work is in terms of the project life cycle." Some project managers find it useful to use the project life cycle as the cornerstone for managing projects. The life cycle recognizes that projects have a limited life span and that there are predictable changes in level of effort and focus over the life of the project. The starting point begins the moment the project is given the go-

ahead. Project effort starts slowly, builds to a peak, and then declines to delivery/closure of the project to the customer. There are a number of different life-cycle models in project management literature. Many are unique to a specific industry or type of project. For example, a new software development project may consist of five phases: definition, design, code, integration/test, and maintenance. A generic cycle is depicted in Figure 2.3 (Larson, 2018:p9).
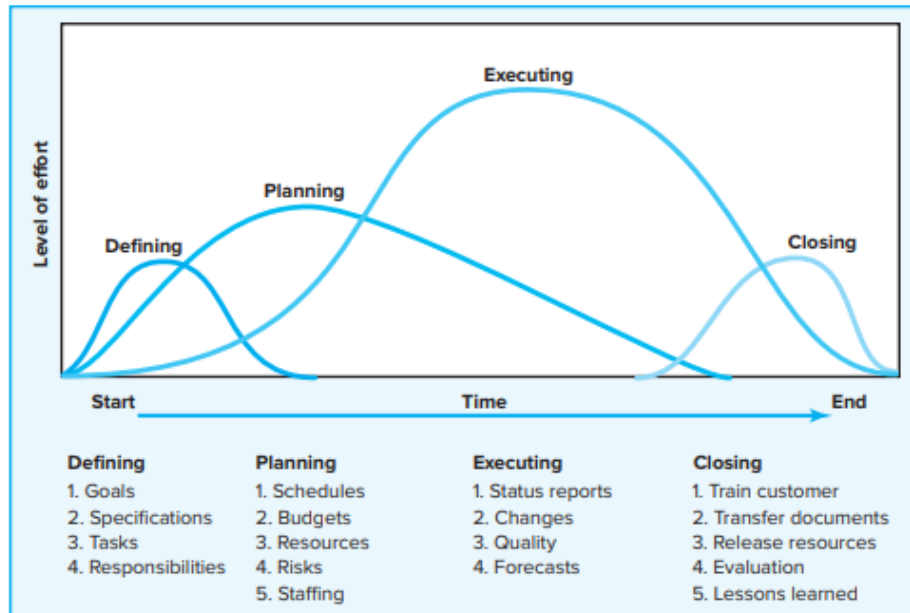
Figure 2.3: Project life cycle

The first stage in the cycle is referred to as 'Defining': specifications of the project are defined; project objectives are established; teams are formed; major responsibilities are assigned. Thereafter, the following stage is known as 'Planning': the level of effort increases, and plans are developed to determine what the project will entail, how it will be scheduled, whom it will benefit, what quality level should be maintained, and what the budget will be. The stage thereafter is referred to as 'Executing': a major portion of the project work takes place—both physical and mental. The physical product is produced, such as a bridge, a report or a software program. Time, cost, and specification measures are used for control. There are various factors that are taken into consideration during this phase such as: whether the project is within the defined schedule; budget allocation; and meeting other specifications. There is need to determine forecasts of each of these measures and the necessary revisions/changes (Ibid). The last phase is

referred to as 'Closing': this includes three activities namely; delivering the project product to the customer, redeploying project resources, and post-project review.

Consequently, the project might include customer training and transferring documents. Redeployment usually involves releasing project equipment/resources to other projects and finding new assignments for team members. Post-project reviews include not only assessing performance but also capturing lessons learnt. In practice, the project life cycle is used by some project groups to depict the timing of major tasks over the life of the project. For example, the design team might plan a major commitment of resources in the defining stage, while the quality team would expect their major effort to increase in the latter stages of the project life cycle. Because most organizations have a portfolio of projects going on concurrently, each at a different stage of each project's life cycle, careful planning and management at the organization and project levels are imperative (Ibid).

2.6   Project management technical skills

Process Groups and *Knowledge Areas* are the core technical subject matters of project management, and these processes along with their individual inputs, tools, techniques, and outputs bring the project to life (Project Management Institute,2018). The Project Management Institute has developed arguably the most significant Project Management standard called the project management body of knowledge (PMBOK) guide to aid practitioners.

The PMBOK Guide is approved as an American National Standard by American national Standard Institute (ANSI) and is recognized by the institute of electrical and electronics engineers (IEEE) as an IEEE standard (IEEE, 2009). The institute describes that much of the knowledge, tools and techniques for managing projects are unique to project management (Ibid).

However, understanding and applying the above described best practices alone may not be sufficient for effective project management. Project Management Institute (2017) states that "While technical project management skills are core to program and project management, PMI research indicates that they are not enough in today's increasingly complicated and competitive global marketplace. Organizations are seeking added skills in leadership and business

intelligence." Members of various organizations state their belief that these competencies can support longer-range strategic objectives that contribute to the triple bottom line**.**

Johnson (2013) stated that to be the most effective, project managers need to have a balance of these three skill sets. It therefore, becomes imperative that one develops and uses the management tools, skills, and expertise. Further to support this Taylor (2006a) said: *Research is an intensely personal activity, strongly dependent on the ideas and imagination of individuals or groups of individuals. . . . Research, therefore, does not lend itself to control and management. Yet, in the fast-changing competitive world of today's higher education, there are constraints that require the application of some sort of management framework*. Barron (2011) summarises the foregoing in table 2.1 (Barron, 2011: p.33).

Table 2.1 Project management areas of expertise

Areas of Expertise
Application knowledge, standards and regulations
Understanding the project environment
Management knowledge and skills
Interpersonal skills

2.6.1   Project management processes and process groups

There are many different ways in which a specific project could be organized. However, there are certain processes that are essential, and there are certain ways of implementing these processes that help to ensure a project's efficiency, effectiveness and success (Oxbridge Academy). Every project management process produces one or more outputs from one or more inputs by using appropriate project management tools and techniques. The output can be a deliverable or an outcome. Outcomes are an end result of a process (Project Management Institute, 2017).

It is important to consider that a project consists of countless processes, from defining a project, to creating a budget, to compiling statistics (Oxbridge Academy). There are, in fact, 47

identifiable processes, according to the PMBOK guide. All these different process, however, can be grouped into 5 categories called the 5 process groups (Ibid).

PMI also advocates that for the project to be successful the project team must select the appropriate processes within the process group to meet the project objectives. These process groups are defined as:

i. **Initiating Process Group** - Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase;

ii. **Planning Process Group** - Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve;

iii. **Executing Process Group** – Those processes performed to complete the work defined in the project management plan to satisfy the project requirements;

iv. **Monitoring and Controlling Process Group** - Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes; and

v. **Closing Process Group** - Those processes performed to formally complete or close the project, phase, or contract (Ibid).

2.6.2   Project management knowledge areas

The project processes referred to in section 2.5.1 can also be categorised by knowledge areas Project Management Institute (2017). Basically, each knowledge area (KA) is a category of concepts and processes with a common goal (Harrin, 2019). The knowledge areas are categorized into ten as given below:

i. **Integration** – Coordinates activities across all project management areas and process groups;

ii. **Scope –** Ensures that the project work includes all elements required to complete the work;

iii. **Schedule** – Ensures that the project work is completed in a timely way;

iv. **Cost** – Plans, estimates, manage and controls project finances;

v. **Quality** – Ensures that the project delivers a quality output that is fit for purpose;

vi. **Human Resource** – Secures, manages and monitors use of human resources throughout the project;

vii. **Communications** – Ensures that communications on the project are planned and carried out appropriately;

viii. **Risk** – Identifies, assesses and manages risk;

ix. **Procurement** – Carries out purchasing and contracting as required; and

x. **Stakeholder** – Identifies and engages stakeholders throughout the project (Ibid).

From the above presentation, it can be said that the process groups are the chronological phases that the project goes through, and the *knowledge areas* occur throughout any time during the process groups. The process groups are horizontal, and the knowledge areas are vertical (Hartney, 2016).

2.7 Project management methodologies

According to the Project Management Institute (2017) methodologies are essentially processes that aim to assist project managers with guidance throughout the project, and the steps to take to completing the tasks. Different methodologies have different strategies that aid in managing issues should they arise during the project's delivery (Ibid).

There are many methodologies to choose from, each with their own set of rules, principles, processes, and practices and the choice depends entirely on the type of project to be undertaken (Muslihat, 2018). It is therefore correct to say that there is no one methodology that is perfect to use for every single project, the implementing team should however, aim to choose a methodology that would maximize the use of resources and time (Ibid).

Many different types of project management methodologies have been developed to meet the specific needs of certain industries or types of projects (LaBarre, 2019). Some of these methodologies are given below:

a) **Waterfall project management** - This is similar to traditional project management but includes the caveat that each task needs to be completed before the next one starts. Steps are linear and progress flows in one direction, like a waterfall. *Best suited for***:** *Large projects that require maintaining stringent stages and deadlines, or projects that have been done various times over where chances of surprises during the development process are relatively low* (Ibid);

b) **Agile project management** - One of the more recognizable project management methodologies, *Agile is best suited for projects that are iterative and incremental*. It's a type of process where demands and solutions evolve through the collaborative effort of self-organizing and cross-functional teams and their customers. Originally created for software development, it was established as a response to the inadequacies of the Waterfall method, the processes of which did not meet the demands of the highly competitive and constant movement of the software industry (Muslihat, 2018);

c) **Lean project management** - This methodology is all about avoiding waste (time and resources). The principles of this methodology were gleaned from Japanese manufacturing practices. *Best suited for an organisation that is not looking for a process as such, but is interested in transforming how they conduct business* (Muslihat, 2018). The main idea behind them is to create more value for customers with fewer resources (LaBarre, 2019);

d) **Scrum project management** – This is comprised of five values: commitment, courage, focus, openness, and respect. Its goal is to develop, deliver, and sustain complex products through collaboration, accountability, and iterative progress. What distinguishes Scrum from the other Agile project management methodologies is how it operates by using certain roles, events, and artifacts (Muslihat, 2018). *Best suited for projects that consist of teams of less than seven people who need a flexible approach to delivering a product or service* (Muslihat, 2018);

e) **Kanban project management -** It is very visual method that aims to deliver high quality results by painting a picture of the workflow process so that bottlenecks can be identified early on in the development process. Similar to scrum method, it uses an Agile framework. Kanban is fit for projects with smaller teams, who need a flexible approach to delivering a product or service. *Kanban is also best suited for personal productivity purposes* (Muslihat, 2018);

f) **Six sigma project management -** First introduced by engineers at Motorola in 1986, it aims to improve quality by reducing the number of errors in a process by identifying what is not working and then removing it from the process. It uses quality management methods, which are mostly empirical and statistical, as well as the expertise of people who are specialists in these methods. *Best suited for larger companies and organizations that want to improve quality and efficiency through a data-driven methodology* (Ibid); and

g) **Project management body of knowledge (PMBOK)** Guide – Not ideally a methodology but a set of standard terminology and guidelines for project management. It states that there are five process groups (Initiating, planning, executing, monitoring & control, and closing) that are present in almost every project.

h) **Project in Controlled Environments (Prince2)** - a structured project management method with emphasis on dividing a project into manageable and controllable stages (Hinde, 2012).

There are many more methodologies and types of project management than listed here, but these are some of the most common.

2.8   Management of research projects

Knowledge may be defined as a familiarity, awareness or understanding of a phenomenon or any observable event or something or someone in terms of the facts, information, descriptions or skills that are acquired through experience or education or observing, discovering or learning (GES 5881 University of Zambia Lecture notes, 2018). Further, scientific knowledge is that which is known through systematic search and exists within and between society's propositions of judgments and beliefs. Therefore, the acquisition of scientific knowledge is accomplished through the conduct of research. Research has a number of definitions with one being "a systematic inquiry to describe, explain, predict and control the observed phenomenon" (ibid).

Research involves inductive and deductive methods (Babbie, 2010). Inductive methods analyze the observed phenomenon and identify the general principles, structures, or processes underlying the phenomenon observed. Deductive methods verify the hypothesized principles through observations. The purposes are different: the former is to develop explanations; and the latter is to test the validity of the explanations. Whatever form the research takes, it is important that the results are delivered within the available resource constraints (Ibid).

According to Roil and Thuiller (2015) academic research faces new methods of knowledge generation that trigger a need for managing research projects. They further investigated whether and to what extent academic research projects can be managed using classical project management (PM) principles. The study revealed that research projects are project management compatible considering certain structural similarities and a cultural acceptance of project

management value. However, the human factors and uncertainties inherent in research are not addressed by classical project management. Roil and Thuiller (2015) thus developed a prescriptive framework for facilitating PM implementation in academic research at the institutional, organisational and operational levels.

As much as Roil and Thuiller (2015) confirmed the compatibility of project management techniques in managing research, this may not be the only way to improve research management. Johnson (2013) states that project management came out of engineering practice and has been adapted to many fields since. However, it has been noted that even when university research projects are well planned, they rarely comply with the specific guidelines and formal requirements of traditional project management. Johnson (2013) further says managing a research/group is an increasingly challenging task. On the one hand one has to be prepared to collaborate and compete at a global level, but on the other you are often obliged to depend on local sources of income which is the most common challenge in Zambia. Furthermore, creating a strategy that will lead to the best outcomes in terms of research impact or innovation requires a highly-specific skill set which frequently lies outside the experience of those chosen to lead, regardless of their professional distinction (Ibid).

The compatibility confirmed by Roil and Thuiller (2015) becomes important due to the fact that research performance is widely considered to be a major factor in a country's economic output and national innovation system, the so-called push toward a western-style knowledge economy (Rinne and Koivula, 2005; Holliday,2012). Therefore, research outcomes have a significant impact both directly and indirectly on an institutions prestige, which in turn attracts/leads to the likelihood of more funding for research from both internal and external sources. Today's leading organizations recognize the importance of research and development (R&D) to maintain and grow their market share (Johnson, 2013).

A scientific researcher's typical activities may include repetitive work in the laboratory, grant writing, book-keeping, and so on, but scientific research is fundamentally creative, and often unpredictable. As often as not, the course the research takes is unexpected. A principle investigator's (PI's) central challenge is to keep the laboratory afloat while stimulating and supporting the highest levels of creative insight and technical innovation (Johnson, 2013). Few

scientists are trained to do this, while with most, it comes only from experience. Some never learn to manage their laboratories effectively, and this puts them at a considerable disadvantage compared to their colleagues. The techniques of project management do help in mitigating this challenge. Given the current economic situation, it is important for research facilities and academia to be viable business entities to survive and thrive. Further, Susan Singer (2018), a Stanford certified project manager and consultant, in her article "Project Management in the Research Environment," advocates for research project management as a sub discipline that can provide the tools and resources for researchers to better organize projects, but with flexibility in the planning process to evolve with the project as needed.

Besides enhancing project management skills, Johnson (2013) proposes that it is required that a sufficient flow of funds to attract and keep top-notch staff, as well as to obtain and maintain the required facilities and equipment should be ensured. Like shareholders of a corporation, stakeholders in research institutions such as funding organizations, the private sector or industry, host institutions, taxpayers, and so on, demand a demonstration of the value they get for the money they spend. This is especially important for the principal investigator (PI) when the time comes to seek grant renewal or tenure. Again, the techniques of project management becomes handy in ensuring that activities or tasks in the research institutions are well managed in order to meet targets, satisfy all stakeholders and therefore, secure funding whilst keeping in mind that basic research "focuses on gaining knowledge instead of driving for new product creation," and thus traditional project management processes cannot be strictly followed (Ibid).

2.9   Research as a collaborative process

According to the Science Business Society Dialogue Conference (2016) "whilst Southern Africa boasts of much excellent science research centres and has an outstanding entrepreneurial community, science and the private sectors do not often sit alongside each other and there are few connections or strategic collaborations".

In Zambia, the research community has appreciable potential that could be harnessed by industry for sustainable economic development. A good relationship between industry and academia has potential for sustainable economic development in Zambia. The whole essence or importance for

this relationship is that it is a vehicle for research and development of the abundant raw materials readily available for exploitation and value addition in the country.

Thus, according to the Zambia Association of Manufactures Report (2017) the chief executive officer emphasized the importance of value addition to local raw materials, with the statement; "Notably the continued level of high dependence on the export of copper and the subsequent need for favorable commodity prices for economic growth has once again left Zambia exposed". This implicitly states that there is need for the country to harness the manufacturing sector for sustainable economic growth through effective and efficient research and development.

However, this desired relationship between industry and the research community may not flourish, as is the case currently in Zambia, due to different reasons. In a number, of instances, the industry does not engage the Zambian research community due to lack of confidence in the institutions and this may be attributed to the perceived inadequate infrastructure and expertise to deliver (Ministry of Science, Technology and Vocational Training, 1996). The collaboration between industry and academia is meant to facilitate research, development and discovery of new knowledge of how to further benefit from the raw materials the country has. This new knowledge has potential to deliver processed materials for export thereby earning the country more revenue. Recognizing that knowledge is reliably acquired through conduct of research, it is therefore, important that the research process should be well managed. The techniques of project management may be utilized to achieve this. Table 2.2 presents the summary of literature reviewed during the study.

Table 2.2: Content Analysis of Literature Reviewed on Project Management Techniques in Zambia

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
Project Management Institute	2017	A Guide to Project Management Body of Knowledge (6th Edition)	Provides the definitions for various project management components and gives guidance on effective project implementation	Descriptive	Makes available proven traditional practices that are widely applied as well as innovative practices that are emerging in the project

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
					management profession.
Will Kenton	2019	Research and Development	Gives the definition of research and development	Descriptive	Explains that research and development is the development of new products.
Merrie Barron and Andrew R, Barron	2011	Project Management for Scientists and Engineers	To get an understanding of the history of project management.	Explanatory	Project Management has been in existence consciously and unconsciously since the beginning of history.
Gray, C.F and Larson, E.W.	2018	Project management: the managerial processes.	To get an understanding of the requirements for optimal project performance.	Case study approach	Gives the triple constrains on a project by illustrating the balancing act of time, cost and scope whilst ensuring quality
Dona, K	2017	How Project Management Techniques can improve research.	To verify the adaptation of project management techniques in order to improve performance of research projects.	Exploratory	Best practices for keeping research projects on track and within budget can be adapted to managing research projects.
Merrie Barron and Andrew R, Barron	2011	Project Management for Scientists and Engineers	To determine the areas of expertise required for successful project implementation.	Descriptive	For successful project management implementation, the following skill set are necessary; the application area of knowledge; standards and regulations in the particular field, understanding the project environment, and the general management knowledge and interpersonal skills.

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
Gray, C.F and Larson, E.W.	2018	Project Management: the managerial process	To understand the basic framework for managing a project.	Descriptive	Project life cycle with the four phases of initiation, planning, execution and closing well explained.
Project Management Institute	2018	A Guide to Project Management Body of Knowledge	To understand the guidelines and standards for effective project management	Explanatory	The project management book of knowledge (PMBOK) Guide is an established reference for successful project management. However, these are a collection of best practices that require tailoring to particular situations
Alan M Johnson	2013	Improving Your Research Management	To understand the skills set required for effective and efficient research management.	Descriptive	It is important to balance the project management technical skills with the general management and understanding the project environment
Will Kenton	2019	Research and Development	Gives an understanding of what research and development is.	Descriptive	The article has described what research and development is but has not been clear on how to optimize the activity
Oxbridge Academy	Accessed 2019	Project Management Processes – What are they?	To get an understanding of project management processes and process groups	Descriptive	A project consists of many processes that need to be logically grouped in order to achieve project objectives.
Project	2017	A Guide to the	To get the	Explanatory	The output can

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
Management Institute		Project Management Body of Knowledge	relationship between project processes, inputs, tools & techniques and outputs		either be a deliverable or and outcome and that the output of a process is usually an outcome.
Elizabeth Harrin	2019	Management (PMBOK 6) With PPT & PDF	Understanding the ten project management knowledge areas	Explanatory	Project management knowledge areas are well explained with emphasis on their importance.
Jon Hartney	2016	Project Engineer – Building better Project Managers	To compare the process groups and the knowledge areas	Explanatory	The *process groups* are the chronological phases that the project goes through, and the *knowledge areas* occur throughout any time during the process groups.
Dinnie Muslihat	2018	7 Popular Project Management Methodologies And What They're Best Suited For	Survey of the project management methodologies.	Exploratory	Different types of methodologies exist for implementers to choose from, each with their own set of rules, principles, processes, and practices. The type of project being implemented usually guides the type to use/tailor.
Olivia LaBarre	2019	Project Management	Survey of the project management methodologies.	Exploratory	Many types of project management have been developed to meet the specific needs of certain industries or types of projects. The article does not give a "blanket"

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
					recommendation for any one type of methodology.
Danny E Banda	2018	GES 5881 University of Zambia Lecture notes	To gain further understanding of Scientific knowledge	Descriptive	Scientific knowledge is known through systematic search and exists within and between society's propositions of judgments and beliefs. This is accomplished through research.
Babbie, E.R	2010	The Practice of Social Research	To gain further understanding of Scientific knowledge	Descriptive	Research may involve analyzing the observed phenomenon and identify the general principles, structures, or processes underlying the phenomenon observed or verifying the hypothesized principles through observations.
Alan M Johnson	2013	Improving your Research Management	To get an overview on Research Management	Exploratory	Managing research activities may be challenging requires strategy and the need to collaborate with others.
Hélène Riol and Denis Thuillier	2015	Project management for academic research projects: balancing structure and flexibility	To investigate whether and to what extent academic research projects can be managed using classical project management (PM) principles.	Survey - Interviews with researchers were conducted by the author	Research projects are project management compatible considering certain structural similarities and a cultural acceptance of PM value.

Author(s)	Year	Title	Objectives	Methodology	Conclusion /comments
					However, the human factors and uncertainties inherent in research are not addressed by classical PM.

2.10   Summary

A range of literature on project management, and how it can be adapted to managing research projects was reviewed. It was noted that Zambian authored literature on the study was scarce. The next chapter examines the research methods used during the study.

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CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter analysed the existing literature concerning project management and its adaptation to managing research projects. This chapter presents the research methodology employed to address the research objectives. The chapter covers the research design that the study adopted, the target population, sample size and sampling technique, data collection instruments, data collection procedure, data analysis and data presentation used in the study.

3.2   Overview on research

Research has evolved during this century from the periphery to the centre of our social and economic life and also the progress which has been made in our society has been largely the result of research (Singh, 2006). According to Reddy (2019) research means to carefully analyze the problems or to do a detailed study of the specific problems, by making use of special scientific methods. The main purpose of research is to inform action, to prove a theory, and to contribute or to develop knowledge in a field or study (Zarah, 2019). There are various different types of research that can be adopted for particular intentions (Lowe, 2016).

The study conducted to determine whether researchers in Zambia were applying project management techniques adapted the applied type of research which aims to generate information that can be directly applied to solve a problem (Abbott and Bordens, 2011). The other types of research that were considered but not used in the study were basic research and action research. Basic research tends not to be directly applicable but is driven by the desire to expand knowledge (Kowalczk, 2013). Action research may entail the community being studied being involved in gathering information and studying themselves (Patton, 1990). Further, community being studied gets involved in the subsequent developments or implementation activities (Meyer, 2000).

3.3   Research design

A research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problems. The plan is the complete scheme or programme of the research. It includes an outline of what the investigator will do from writing the hypotheses and

their operational implications to the final analysis of data (Kerlinger, 1986). A traditional research design is a blueprint or detailed plan for how a research study is to be completed - operationalizing variables so that they can be measured, selecting a sample of interest to study, collecting data to be used as a basis for testing hypotheses, and analyzing the results (Thyer, 2010). The study considered a number of approaches for planning the research which included; Case study which involving an in-depth study of an individual (Hale, 2018); Correlational research which aims at determine whether two or more variables are statistically related (Abbott and Bordens, 2011); Exploratory research which studies a topic that has not been studied more clearly (Shields and Rangarjan, 2013); Experimental research which aims to derive verified functional relationships among phenomena under controlled conditions (Singh, 2006); Explanatory research in which the research attempts to explain, rather than simply to describe the phenomena studied (Given, 2008); and Descriptive research design.

This study employed the descriptive research design in trying to establish whether research institutions in Zambia were using project management techniques. The rationale for selecting the descriptive research design in this study was because the research involved describing aspects relating to the way the target population comprising academicians and researcher manage research activities and not to explain why, when or how the research management activities were being conducted. Shields and Rangarjan, (2013) proposes that a descriptive research design aims to describe the characteristics of a population or phenomena being studied and not to answer questions about how/when/why the characteristics occurred. The study therefore, did not involve influencing the respondents in any way but merely collecting information and describing the results (Shuttleworth, 2018). The study also went further to evaluate the extent to which the project management techniques were being utilized by researchers in research institutions in Zambia by employing a field surveys assurveys allow for data to be analyzed for frequencies, averages and patterns as this was one of the intentions of the study (McCombes, 2019).The field surveys were determined to be ideal for evaluating whether academic and research institutions were using project management techniques in research management basing on the discussion by Abbott and Bordens (2011) that field surveys are good for evaluating specific attidutes and can also be used to evaluate behaviors.(Abbott and Bordens, 2011). The field survey instruments employed in the study included the questionnaires and structured interviews where participants

answered questions administered through interviews or questionnaires. The questions in the questionnaires and structured interviews, respectively, were properly constructed and clearly written and included both open ended and closed ended questions (Hale, 2018).

The open-ended questions allowed for a greater variety of responses from participants but admittedly were difficult to analyze statistically. Closed-ended questions were easy to analyze statistically, but seriously limited the responses that participants were able to give. The likert-type scale was also used and this was easy to analyse statistically agreeing with discussions that many researchers prefer to use a Likert-type scale because it's very easy to analyze statistically (Jackson, 2009).

3.4   Data collection

The study utilized both primary and secondary methods of data collection. Data collection is the accumulation of specific evidence that will enable the researcher to properly analyse the results obtained from the research activities implemented by using the chosen research design and procedures in order to verify the research hypotheses (Singh, 2006). Data means observations or evidences and is both quantitative and qualitative in nature. The main difference between qualitative and quantitative data is that qualitative data is descriptive while quantitative data is numerical (Lithmee, 2018).

The methods of collecting data can be divided into two categories: primary methods of data collection which are used by researchers to collect data directly from the source, rather than from previously conducted research, and secondary methods of data collection which involve the collection of information from studies that other researchers have made of a subject.

3.4.1   Primary research

The study used questionnaires and interviews to collect primary data and these were constructed based on the research objectives. However, several methods can be used to collect primary data but the choice of a method depends upon the purpose of the study, the resources available and the skills of the researcher (Kumar, 2011). In selecting a method of data collection, the socioeconomic–demographic characteristics of the study population play an important role. Further, in order to ensure quality of data collected the clarity with which the purpose and

relevance of the study are explained to potential respondent's matters (Ibid). According to Ajayi (2017) primary data sources include observations, experiments, questionnaires, and personal interviews among others.

Questionnaires were preferred since they were easy to administer and were time saving (Mugenda, 2003). The questionnaires contained closed-ended questions and a few open-ended questions which elicited qualitative data on subjective thoughts and different responses related to specific academic and research institutions. These questionnaires were self-administered and contained four sections as follows:

  i.   Section A – general information about the respondent;
 ii.   Section B – information about the respondents' institutions;
iii.   Section C – information regarding project management techniques; and
 iv.   Section D – information on the monitoring and evaluation of research projects.

3.4.1.1   Questionnaires

The study employed self-administered questionnaires that were distributed to respondents both electronically and also delivered by hand. This meant that the respondent had to read the questions on their own interpret and then respond without getting further information from the researcher. A questionnaire is a written list of questions, the answers to which are recorded by respondents (Kumar, 2011). As there is no one to explain the meaning of questions to the respondents in a questionnaire, it is important that the questions are clear and easy to understand. Also, the layout of a questionnaire should be such that it is easy to read and pleasant to the eye and the sequence of questions should be easy to follow (Ibid).

One reason questionnaires were selected as a data collecting tool in this study was that it was found convenient to reach the various respondents located in different institutions. Further, Singh (2006) proposed that a questionnaire is a major instrument for gathering data in descriptive studies where the sources are varied and widely scattered. It is very handy in cases where one cannot conveniently see personally all the people from whom the responses are required (Gillham, 2008).

Besides the above reasons for selecting questionnaires in this study, the method gave respondents time to consider their responses carefully without interference and that it made it possible to provide questionnaires to large numbers of people simultaneously rendering it a cheap tool (Munn and Drever, 1999). Questionnaires also made it possible to distribute identical sets of questions to the many respondents, therefor, ensuring uniformity. With closed-ended questions, responses were standardised, which assisted in interpreting from the large numbers of respondents andaddressed a large number of issues and questions of concern in a relatively efficient way.. Often, questionnaires are designed so that answers to questions are scored and scores summed to obtain an overall measure of the attitudes and opinions of the respondent. However, one key concern with questionnaires is that they may contain quite large measurement errors (Alwin, 2007).

While there are many positives to questionnaires, dishonesty can be an issue as well as that there is a chance that some questions will be ignored or left unanswered (Debois, 2019). The trouble with not presenting questions to users face-to-face is that each may have different interpretations of the questions and it cannot fully capture emotional responses or feelings of respondents. Respondents may have bias towards an issue and therefore, give inadequate responses (Ibid).

3.4.1.2 Interviews

Other than the questionnaire survey, the study employed structured interviews in order to collect primary data. Interviewing is a technique that is primarily used to gain an understanding of the underlying reasons and motivations for people's attitudes, preferences or behavior. Interviews can be undertaken on a personal one-to-one basis or in a group (Ajayi, 2017). Interviews may be structured, unstructured where questions can be raised on the spur of the moment, depending upon what occurs in the context of the discussion (Kumar, 2011), and semi structured interviews which involve a series of open ended questions providing opportunity for the interviewer and interviewee to discuss certain questions in more detail (Mathers, Fox, and Hunn, 1998).

Structured interviews enabled for the interviewer to ask each respondent the same questions in the same way using tightly structured schedule of questions very much like a questionnaire. The questions contained in the structured interview guide were planned in advance.

3.4.2 Secondary research

Besides the collection of primary data using questionnaires and structured interviews, the study also collected secondary data. This type of data collection involved the collection of information from studies that other researchers have conducted. The two easiest and most accessible places to find this information are libraries and the internet (Dawson, 2002). Any information obtained from secondary sources must be carefully assessed for its relevance and accuracy. Secondary research data compliments primary data during research. The study considered two major sources for secondary data.

3.4.2.1 Published sources

Published sources were drawn from the following:
   i.   official publications of central government and line ministries;
   ii.   official publications of semi government statistical organizations, like Central Statistical Office;
   iii. official publication of foreign governments or international bodies like the United Nations;
   iv.   reports and publications of grant funding agencies;
   v.   reports submitted by economists, re-search scholars, universities and various educational and research institutions;
   vi.   reports of various committees and commissions appointed by government;
   vii. newspapers and periodicals;
   viii. articles reproduced online; and
   ix.   books on topics related to topic of study

3.4.2.2 Unpublished sources

There are various sources of unpublished statistical material such as the records maintained by private firms, business enterprises, scholars, and research workers among others. These institutions may not like to release their data to any outside agency (Sigdel, 2011). The statistical data needn't always be published.

3.5   Sampling methods

Sampling means choosing a smaller, more manageable number of people to take part in the particular research. According to Dawson (2002) in quantitative research, it is believed that if the sample is chosen carefully using the correct procedure, it is then possible to generalise the results to the whole of the research population. For many qualitative researchers however, the ability to generalize their work to the whole research population is not the goal.

The sampling method that was employed in the study was purposive sampling. This is a non-probability technique of sampling. In general two types of techniques of sampling are employed, that is probability sampling and non-probability sampling. Probability sampling is based on the fact that every member of a population has a known and equal chance of being selected (Stephanie, 2015). Some methods of probability sampling include simple random sampling, systematic sampling, stratified sampling, multiple or double sampling, multi-stage sampling, and cluster sampling. Non-probability sampling techniques use non-randomized methods to draw the sample (Showkat and Parveen, 2017).   Non-probability sampling method mostly involves judgment and may include incidental or accidental sample, judgement sample, quota sample, and snowball sampling.

Purposive sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher and important for the study (Fink, 2003). This technique was preferred because it was fast, inexpensive, easy and the respondents were readily available (Cooper, 2001).

A representative sample was selected in order to obtain more scientific results that could be used to represent the entirety of the sampled population. A list of all research and development institutions, and universities was drawn. From this list, the ones specializing in scientific research were identified and picked through purposive sampling and these were the target sources of respondents for the research. Before distribution of the questionnaires, the researcher would engage offices responsible for research or administration to explain the purpose of the research and to describe the characteristics of the potential participant who should be active in research.

3.6   Target population and sample size

The target population for study involved research administrators, government officials, academicians and researchers from, research granting institutions, government ministries/departments, universities and research and development institutions in Zambia. The sample size for the questionnaire survey was 42 and that for the structured interviews was 10, respectively. The target population was selected because of their relevance to the study and also that they fit in the time frame and resources of the research. The purposively sampled respondents were asked for consent and approval to answer the questionnaire. According to Delice (2010: 8), the researcher should decide on an appropriate size for sample depending on the research topic, population, aim of the research, analysis techniques, and sample size in similar research, the number of the subgroups in the sample, population variability and research design. Although sample size between 30 and 500 at 5% confidence level is generally sufficient for many researchers, the decision on the size should reflect the quality of the sample in this wide interval.

3.7   Methods of data analysis

The study employed a combination of qualitative and quantitative data analysis approach to analyse the obtained results. Data obtained from the field in raw form was difficult to interpret and therefore, was cleaned, coded and then analyzed (Mugende, 2003).

3.7.1   Qualitative approach

In this study, qualitative data obtained from questionnaires and interviews was analyzed descriptively, grouped into meaningful patterns, and themes that were observed, to help in the summarizing and organization of this data.

Qualitative research is a scientific method of gathering non-numerical data and analyzing it by examining, categorizing, tabulating and recombining evidences in order to address the research questions (Barbie, 2014).

Broadly, there are three ways in which findings in qualitative research can be presented; developing a narrative to describe a situation, episode, event or instance; identifying the main

themes that emerge from the field notes or transcription of in-depth interviews and writing about them, quoting extensively in verbatim format; and quantifying the main themes in order to provide their prevalence and thus significance (Kumar, 2011).

3.7.2 Quantitative approach

Quantitative analysis was used to analyse the quantitative data through the use of statistical techniques such as frequency counts, percentages, pie charts and tabulation to show differences in frequencies. Bar charts were used to display nominal or ordinal data. Statistical Package for Social Sciences (SPSS) and Microsoft Excel software was used to aid in data coding, data entry and analysis of quantitative data obtained from the closed ended questions.

Quantitative research is the systematic empirical investigation of observable phenomena using statistical, mathematical, or computational techniques (Given, 2008). A quantitative data analysis is one which uses the data collected in the analysis to come to inferences which hold true in general as well as in particular instances of the main module on which the analysis is being based. The report of a quantitative data analysis must be written accurately with the necessary pictorial or graphical representations (Data Tracker Pvt. Ltd, 2011). According to Singh (2006) two types of statistical analysis suffice and these include descriptive and inferential statistics, respectively. Descriptive statistical analysis aims to describe what is going on in a population (Taylor, 2019), whereas, Inferential statistical analysis is used to understand trends and draw the required conclusions about a large population by taking and analyzing a sample from it (Andale, 2014).

3.8 Summary

This chapter outlined the methodology used to collect data in order to address the study objectives. The study employed a descriptive research design in trying to establish whether researchers and research institutions in Zambia were using project management techniques when implementing the research projects. Primary data was collected using questionnaires and structured interviews with the secondary data being collected from books, journals, internet, reports, newspapers, and conference proceedings. The sampling method used was purposive. A

mix of qualitative and quantitative techniques was used to analyse the data collected. The next chapter discusses and analyses the data collected in order to address the study objectives.

CHAPTER FOUR: DATA COLLECTION AND ANALYSIS

4.1   Introduction

Chapter three described the research methodology adopted for this study to satisfy the research objectives as set out in Chapter one and had highlighted the research design, target population, the sample and sampling process. The previous chapter also indicated that the most appropriate method of data collection for this study was through structured interviews and questionnaires. The areas discussed in chapter three are important as they provided the basis on which the findings of the research could be generalized and authenticated. The selected method of data collection enabled for the results presented in chapter four to be reliably collected and analysed. This chapter presents the results of the conducted to determine whether academic and research institutions were using project management techniques in research management.

4.2   Background to the results

The findings presented in this chapter were processed from the data obtained from respondents coming from various academic and research institutions in Zambia. The collection and analysis of data was aimed at meeting the overall objectives of the study which was to determine whether research institutions in Zambia were using project management techniques in managing research projects. Questionnaire responses from the respondents have been presented and analysed with the findings indicating that; the majority of the research and academic institutions in Zambia are using project management techniques in managing research projects. The total number of questionnaires distributed was 50 and only 42 (84%) were received. The remaining 8 (16%) questionnaires were not received.

Further to the self-administered questionnaire survey, 13 appointments for structured interviews were made with different participants from the respondents in the questionnaire survey but only 10 were successfully conducted. The feedback from the structured interviews was in agreement with the questionnaire survey responses even if the two were structured differently. The results of the questionnaire survey and structured interviews, respectively, are presented separately.

4.3   Questionnaire survey results

The participants in the self-administered questionnaires were assured of anonymity and explained to on the objectives of the study. Further, informant consent forms were made available to the respondents who signed them to confirm that they participated freely and not forced to participate. The procedure used in administering the questionnaires increased the confidence in the results of the study as there was no undue pressure on the respondents. The questionnaire survey was undertaken between April 2019 and September 2019. Details of the institutions and participants involved in the study are shown in Appendix A1.The questionnaire was divided into four sections namely; section A which sought to get general information about the respondents who participated in the study; section B which contained questions related to the research or academic institution the respondents worked for; section C which discussed project management techniques and processes employed by researchers and the institutions they worked for; and section D which focused on monitoring and evaluation of research projects.

The preparation of the questionnaire was characterized with several reviews until the final draft was pilot-tested with two participants to get feedback on the clarity and ambiguity of the questions as well as on the general appeal of the questionnaire. The final approved questionnaire was administered to the identified respondents. Supporting documents during the study included the introductory letter from the department of Civil and Environmental Engineering – University of Zambia, as Appendix 2, and the informant consent form. The questionnaire is attached as Appendix 3 and the informant consent form is attached as Appendix 4, respectively. Both descriptive and inferential statistics were employed in the study. Inferential statistics infer from the sample data what the population thinks and descriptive statistics merely describe what is or what the data shows (Torchim, 2006). The questionnaire results are presented as outlined below:

   i.   Respondents profile;
   ii.   availability of policies and guidelines for managing research projects;
   iii. application of project management techniques in research institutions;
   iv.   application of project management techniques by researchers;
   v.   monitoring and evaluation of research projects;
   vi.   challenges in managing research projects; and
   vii. identified weaknesses in the research project management frameworks.

4.3.1 Respondents' profile

The information collected and used to profile the respondents from the questionnaire survey included gender, age, qualifications, years of experience, and institutions the respondents worked for. In the study 83% of the respondents were male and 17 % were female. Majority of the respondents to the questionnaire came from public institutions with 14% coming from private institutions.

One important factor to the validity of the study results is the qualifications of the respondents because; the level of academic education gives an indication of the ability for one to conduct research. Figure 4.1 shows the percentage breakdown of the respondents by academic qualifications. Noticeably, the majority of the respondents had a doctorate degree at 67 %, and 33 % master's degree. Appendix A5 shows the detailed distribution of respondent's qualifications per institution.
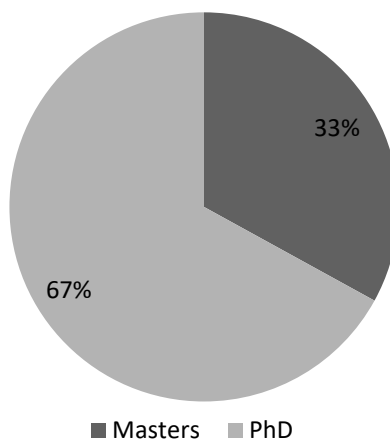
Figure 4.1: Percentage distribution of respondents' academic qualifications

Since the percentage of Doctor of Philosophy (PhD) degree holders was higher than that of master's degree holders, the results would be reliable as majority of the respondents were considered to be competent in conducting research. However, considering other factors besides the academic qualifications would further confirm the reliability of the results.

The other factor of interest in the study was the respondents' number of years of experience in conducting research. Figure 4.2 gives the percentage distribution of the respondents experience in conducting research. The majority (31%) of the respondents had experience ranging from 11 years to 15 years and 2 % of the respondents had more than 31 years of experience in conducting research. Appendix A6 shows the detailed distribution.
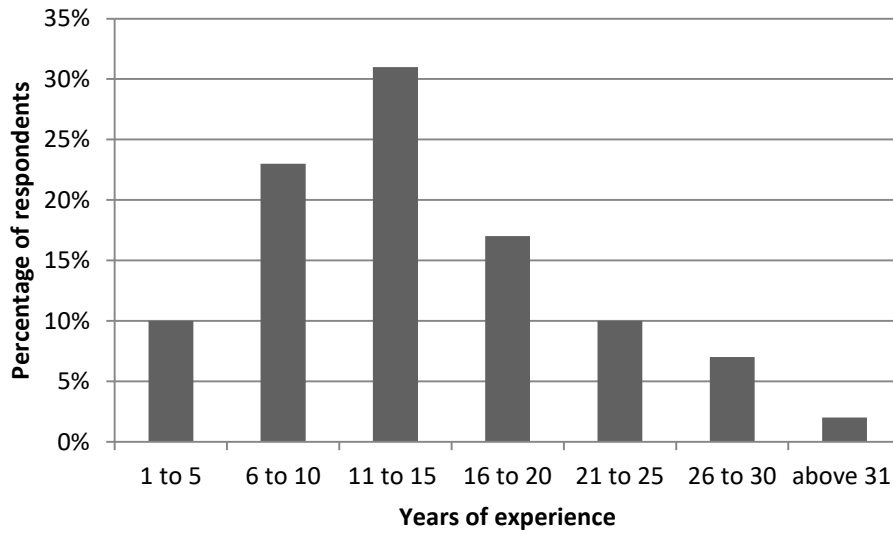
Figure 4.2: Percentage distribution of respondents experience in conducting research

The results in figure 4.2 shows that out of the sample interviewed, 67 % of the respondents had more than 10 years of experience in conducting research and this gives assurance that the information collected would be reliable and based on actual work done.

With regards to the respondents' employment by title, figure 4.3 gives a breakdown of the sample in the study. The distribution confirms a mix of respondents who are employed as researchers and those who combine teaching and research. The results obtained also show that the respondents had different job descriptions, and worked in different environments with different demands. This mix would render the data collected more reliable as it is not biased to one category of respondents.
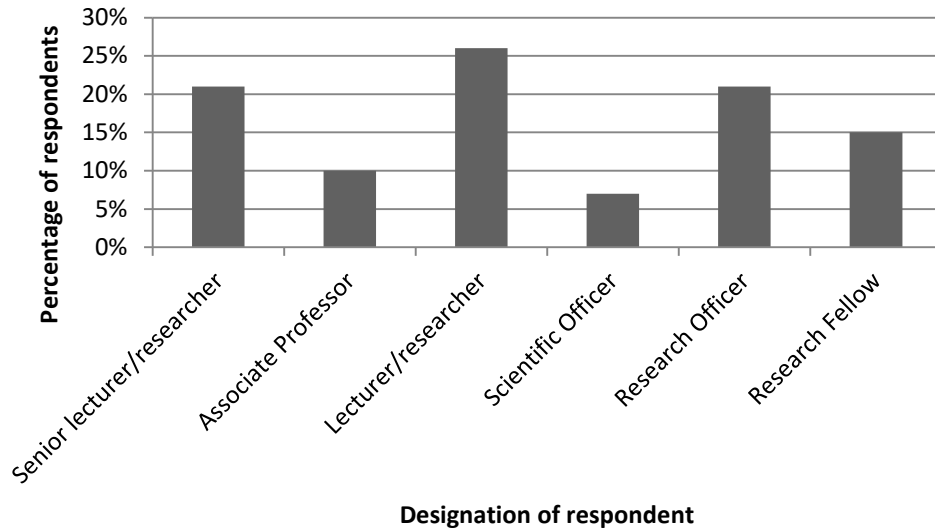
Figure 4.3: Distribution of respondents' designation

4.3.2 Availability of policies and guidelines for managing research projects

The study involved the determination of whether the academic and research institutions had already developed policies or guidelines for managing research projects and whether these institutions kept databases for the research projects undertaken. The study also sought to understand the assessment criteria used by these institutions to determine the performance of the research projects undertaken.
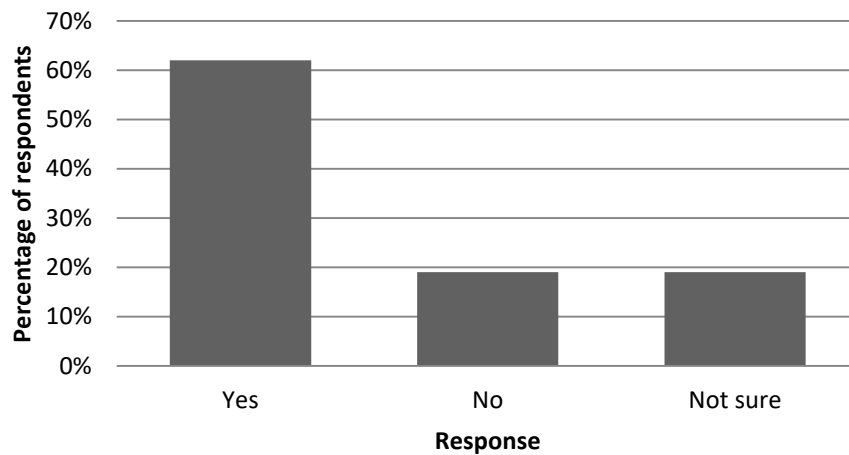
Figure 4.4: Percentage distribution of availability of guidelines for managing research

From Figure 4.4 it can be seen that majority of the respondents to the questionnaire said their institutions have policies or guidelines for managing research. However, 19 percent said that their institutions did not have policies or guidelines for managing research with the other 19 percent saying that they were not sure whether their institutions had policies or guidelines for managing research projects. Further, 58 percent of respondents coming from public institutions and 83 percent coming from the private institutions said their institutions had policies or guidelines with 19 percent from public and 17 percent from private institutions saying they were not sure whether their institutions had policies or not for managing research. It is expected that because of this result, the majority of respondents came from institutions that were positioned to conducting research by virtue of them having frameworks for optimizing research management and that the number of private institutions having policies is relatively hiher than the public institutions.

As much as the study results indicated that majority of the respondents said the research institutions they work for had policies or guidelines for managing research projects, only 40 % confirmed that their institutions kept databases for the research projects undertaken in the past. 31 % said their institutions did not have databases and 29% were not sure whether their institutions kept the data bases or not. Combining the two results may indicate that the research management systems in these institutions require some evaluations.

Concerning the criteria used to assess the impact of research projects in the academic and research institutions, 73 percent of the researchers said their institutions look at outcomes of the research projects, 68 percent of the researchers said that besides the outcomes they also look at meeting the objects of the research projects, and 32 percent of the researchers pointed to financial impact being a factor. , with 27 percent saying financial impact is not a factor and 41 percent not sure whether financial impact is a factor or not.

4.3.3 Application of project management techniques in research institutions

Figure 4.5 shows the extent to which organisations used project management techniques in managing research projects. The data analyzed show that 58 % of the respondents strongly agreed that their organisations used project management techniques in managing research projects, while 21 % of the respondents stated that their organizations did not use project management techniques in managing their research projects. Moreover, out of the total respondents interviewed during the study, 21 % indicated that they were not sure whether or not their organisations used project management techniques in managing research projects.
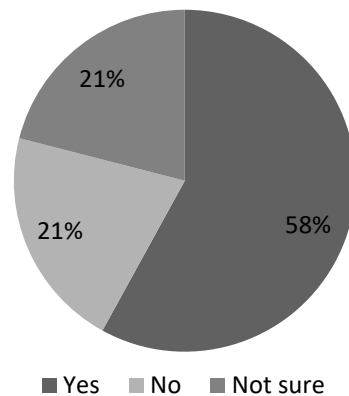
Figure 4.5 Percentage distribution of organisations usage of PM techniques

The findings disaggregated into the public and private research institutions showed that the percentage of public institutions that apply project management techniques was higher than that of the private institutions with 50 percent of the respondents from the private institutions confirming that their institutions use project management techniques and 50 percent saying they were not sure whether their institutions apply project management techniques.

4.3.4 Application of project management techniques by researchers

The data analyzed show that 50% of respondents strongly agreed that they were knowledgeable in the use of project management techniques, and 50% of respondents stated that they were not

knowledgeable in the use of project management techniques. Figure 4.6 illustrates this distribution.
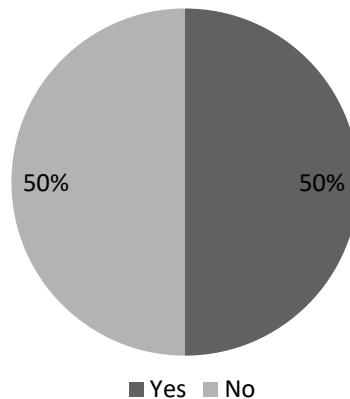
Figure 4.6   Percentage distribution of researcher's usage of project management techniques

Comparing this result in 4.3.4 to the result under 4.3.3, it shows that though the research and academic institutions were using the project management techniques, the individual researchers were using these techniques to a lesser extent. Further to the result in Figure 4.6, the findings indicate that the percentage of researchers in private institutions that use project management techniques is higher at 56 percent than the percentage in public institutions at 50 percent.

The distribution in figure 4.6 was determined by following the steps below:

a) Firstly, each individual question (Q 12 – Q 17), was checked to determine whether a particular respondent had more (S = **x**) or less scores (S = **y**) answering to the question;

(i) For S = x: the respondent is most likely knowledgeable/uses that particular knowledge area.

(ii) For S = y: The respondent is most likely not knowledgeable/use that particular knowledge area.

b) Secondly, for each questionnaire/respondent, the x scores were summed (Q = **X** – more likely to use project management techniques) up and also the y scores (Q = **Y-** Less likely to use/knowledgeable about project management techniques).

c) Now comparing the number of respondents with X scores against those with Y scores, it was found that X=Y. This result shows that the number of respondents who were knowledgeable and utilized project management techniques in managing their research projects was equal to those that did not.

4.3.4.1 Project Management knowledge areas

The results in figure 4.6 show that the respondents were generally conversant with the discussed project management knowledge areas of Integration Management, Time Management, Cost Management, Risk Management, Scope Management, and Quality Management.

For *project integration,* the findings indicate that majority of the respondents do not implement three (developing a charter, developing scope statement, and scope changes control) out of the six project integration activities during the execution of projects. The results also showed that most of the respondents only implemented two out of the six project integration activities (research management plan and monitoring and control) and implementation of the 'direct research project execution' activity, stood at 50 percent yes and 50 percent not.

With project *time management*, the data collected showed that the majority of the respondents implemented five out of the six project time management activities in their research projects while 44 percent indicated that they implemented schedule control. The five project time management activities implemented by the researchers include; definition of research activities, sequencing of research activities, estimation of activity resources, duration estimation and schedule development. One respondent further added that they used Gantt Chart/implementation schedule as a tool for time management.

Regarding the question about the *cost management* techniques employed when managing their research projects, majority of the respondents indicated that they implemented 2 out 3 of the cost management activities which are cost estimating, and cost budgeting, respectively. However, 60 percent of respondents indicated that they did not have cost

control mechanisms in place, while a minor 40 percent of the respondents indicated that they implemented cost control techniques in their research projects.

As with the other knowledge areas addressed, respondents were required to identify the project *risk management* activities used when conducting research. Majority of the respondents said that they did not implement 4 out of the 5 project risk management activities. The four risk management activities include, risk management planning, qualitative risk analysis, risk response planning and risk monitoring and control. Conversely, 51 percent of respondents stated that they implemented risk identification as a risk management mechanism, while 49 percent did not identify potential project risks. Furthermore, with regards to risk monitoring and control activities, 37 percent of respondents implemented this technique, while a majority of 53 percent of respondents indicating that they did not implement this mechanism, a further 10 percent of the respondents indicated the use of other techniques for risk monitoring and control functions.

For *project scope management*, majority of the respondents indicated that they did not use scope control and scope verification out of the five scope development activities. Moreover, 72 percent of respondents indicated that they defined the project scope, while 28 percent indicated that they did not define the project scope in the process of scope development. 50 percent of respondents indicated that they implemented scope planning and work breakdown structure, while a respective 50 percent of the respondents did not implement the aforementioned mechanisms. One respondent on the study further reiterated that, "*Available funding also determines the scope*".

For *project quality management*, majority of the respondents on the study indicated that they used the respective quality monitoring activities to assess the quality of research work which included quality planning (54 percent), quality assurance (70 percent) and quality control (65 percent).

4.3.5   Monitoring and evaluation of research projects

The results in figures 4.7 (a) and 4.7 (b), respectively, show the percentage distribution of the type of monitoring and evaluation mechanisms employed in the target research institutions when managing research projects. The two types of monitoring and evaluation considered in this study were activity-based monitoring and evaluation and results-based monitoring and evaluation. Results-based monitoring and evaluation emphasizes on assessing how outcomes are being achieved over time, whilst the activity-based approach focuses on how well the project activities are being implemented and not on the outcome.

Based on figure 4.7 (a), majority (82 percent) of the respondents in the study indicated that they used '*results based project monitoring'* to assess effectiveness of the research work. The result in Figure 47 (a) is also reflected in the disaggregated data which shows that the 80 percent of respondents from the private institutions said their institutions apply results based monitoring and 82 percent of the respondents from the public institutions said the same. From Figure 4.7 (b) is seen that 59 percent of the respondents indicated the use of the *activity based monitoring approach*. For activity based monitoring and evaluation, 62 percent of respondents from the public institutions confirmed using activity based monitoring and 40 percent confirmed using activity based monitoring. One respondent further added that, "it is a loose combination of both, but not fully spelt out to researchers', while another respondent in the study stated that, 'the impact on the communities and policy formulation, is the major indicator of effectiveness of research project management".
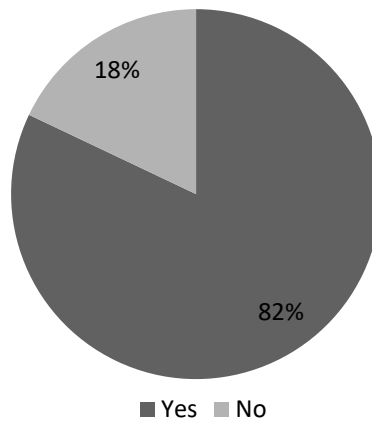
Figure 4.7 (a):   Percentage distribution on the use of results based monitoring
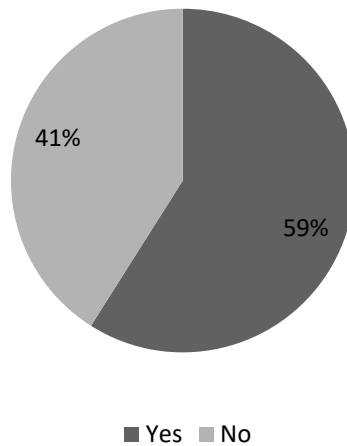
Figure 4.7 (b):   Percentage distribution on the use of activity based monitoring

4.3.6   Challenges in managing research projects

The findings of the study in relation to the potential challenges researchers face when implementing research projects were varied. Similarly, the suggestions given by the respondents for improving the effectiveness of research management were many.

Many respondents in the study cited *inadequate training* in project commentary skills like project management as a major challenge. The specific responses were as follows: lack of proper training in project management techniques; negative mindset, Lack of exposure/knowledge on project management techniques*;* lack of guidelines for projects, lack of dedicated project management teams, researchers multitask as project managers.

The other major challenge cited by the respondents was that of *insufficient funding* for research projects. Specifically the challenges presented were as follows: Inadequate financial resources as some aspects of project management require funds*;* lack of transport and equipment to facilitate for activities; financial inadequacy which hinders the implementation of project implementation*;* delays in release of funding for research*,* funding vs. funder demands on the scope of work; limited financial resources and tools like software; and budgeting/financial constraints.

Besides the two challenges mentioned, the study found that research activities in Zambia may be affected by potential inefficiencies in the support departments within academic and research institutions. From the responses obtained, the following challenges associated with the support departments were noted:

i.   bureaucracy in the procurement process;
ii.   poor project governance resulting into poor risk management;
iii.   irregular disbursement of the project funds;
iv.   Lack of planning;
v.   Lack of coordination;
vi.   research management not being prioritized; and
vii.   Lack of incentives for conducting research due to low appreciation by the other units.

Other constraints attributed to by the respondents included the following: implementation without project management tools makes control and follow ups difficult; the work environment, access to funds, stores management, transportation; inadequate infrastructure, and human resource; no standard systems for quality control. Some researchers went further to say research activities are affected by factors from outside the institution like clearance of

protocols by regulatory authorities taking long and institutions working in isolation which may lead to duplication of efforts.

The challenges presented above revolve around three key issues and these cut across all sectors. It is expected that research performance would be enhanced if these three issues are resolved.

1) National research agenda – the country seemly does not have a common document to guide research. This has led to a situation where policies or guidelines for academic and research institutions that have the capacity develop their own guidelines have been developed but these do not feed into a national strategy for research. As a result, these institutional policies or guidelines may fail to effectively contribute to the national development plans. The lack of a national research agenda has led to institutions working in 'silos' and because of this it's more likely that research efforts may be uncoordinated with the risk of duplication of efforts. Another result for lack of a national research agenda would be a situation where a certain institution lacking a particular piece of equipment fails to progress because they are not aware that another institution in the country has that equipment. It is expected that within the framework of this national research agenda, platforms for information sharing would exist.

2) Financing – This is an issue that was common to all participants in the study. Evidently, research in Zambia does not receive the desired funding neither from the national treasury nor from the private sector. Naturally, the little available financial resources from government are spread out to the government supported academic and research institutions like UNZA, CBU, NISIR, and ZARI among others. The said budget allocations do not suffice to fund any meaningful research. Industry which should be collaborating with research institutions and fund demand driven research does not do that in Zambia. This may be attributed to the fact that the majority of players in the private sector are foreign owned corporations who fund research in their countries of origin. Further, the Zambian academic and research institutions have not positioned themselves well to give confidence to these multinational corporations.

3) Training/skills and infrastructure – This aspect refers to skills in core disciplines and/ or complementary skills. The lack of project management and financial management skills explains this. For infrastructure, there are instances when researchers send samples outside the country for testing and this may be due to either, because of working in 'silos' one

institution does not know that another institution in the country has that particular piece of equipment or in the entire country no institution has that particular equipment. Further, research infrastructure in the country is outdated and require replacing/upgrading. The poor state of research infrastructure in the country does not give confidence to stakeholders.

Given the potential challenges identified, the respondents made the following suggestions;

i. There is need to ensure that all research staff are trained in vital complimentary skills like project management;

ii. Regular review of projects implemented is required with focus on result than activities;

iii. Funds should be disbursed on time;

iv. Work on the compliance of existing research monitoring guidelines, and provide trainings in research management;

v. Training in project management and utilisation of project management software for researchers is cardinal;

vi. Structured support for quality proposals for presenting to external funders of projects:

vii. The institution needs to engage industry for research projects to have meaningful outputs and overrall management;

viii. Improving procurement procedures, and training of financial officers to handle project funds;

ix. Sufficient funds should be availed so that there is no deviation from the initial project plan;

x. Capacity building, and giving clear/proper guidelines:

xi. Proper planning, organisation and efficient use of time and resources;

xii. Ensure adequate training and mentorship for field assistants; and

xiii. Have active research identification activities and promoting inter-faculty research collaborations.

One respondent presented the following suggestion, 'Ways of improving performance and management of research projects should include investment in research that would ensure adequate funding and employment of appropriate human resource as well as establishing necessary research support infrastructures. There must also be deliberate formulation of

institutional research policy that ensures research appropriates project governance and thereby strengthening project risk management systems.'

4.3.7 Identified weaknesses in the research project management framework

Respondents were asked to state whether or not they had identified any weaknesses within the research management frameworks in their respective institutions. The results in figure 4.8 shows that majority (60 percent) indicated that they had identified weaknesses, while 37 percent indicated that there were no weaknesses in the RM framework and 3 percent of the total respondents on the study indicated other specific reasons regarding research management framework weaknesses in their respective research institutions
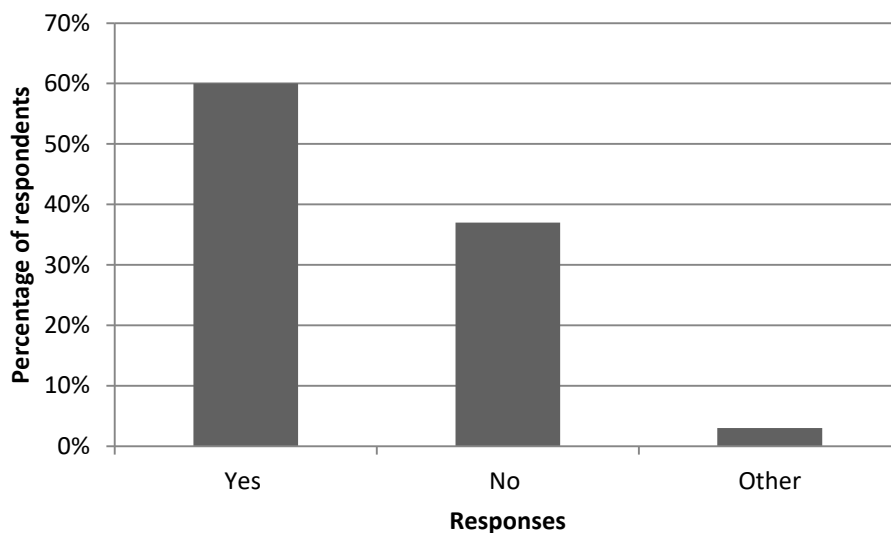
Figure 4.8   Weaknesses in research management framework response rate

From the feedback collected, one respondent stated that among the major weaknesses and vital gaps in their respective research institution, 'there are *no proper guidelines* given to researchers though the guidelines might be there somehow' and that "there is need for mindset change amongst researchers". Various respondents during the study identified a wide range of *financial constraints* as a major weakness characterized by their respective research institutions. Other financial related constraints were stated by different respondents as follows:

a) inadequate finances as a result of biased funding models for some research funding agencies;

b) non provision of counterpart funding/funds for seed and variety release;

c) disbursement of funds usually not on schedule;

d) procurement of research material is cumbersome and long, and deficient financial management; and

e) available resources being thinly spread among different research programmes.

A number of respondents pointed out that *monitoring and evaluation* of research projects was an eminent weakness that has been identified in the various research institutions. The respondents specifically mentioned the following:

a) monitoring is left too long before measures are taken;

b) poor monitoring of research projects and low levels of reporting during execution;

c) follow up is very weak;

d) some works are not done according to what was initially planned; and

e) poor quality data or feedback is often collected from respondents.

Other than the above weaknesses mentioned, most of the respondents echoed that their respective research institutions *lacked a proper framework* to guide and oversee the holistic conduct of their respective research projects; "no proper data base; there are no standard operating procedures across the university; there is no coordination and no standard format; lack of risk assessment framework management'.

Other respondents identified a few unique weaknesses in their research institution and these included the following:

a) lack of or inadequately planned monitoring and evaluation framework;

b) poor project governance resulting into poor risk management;

c) poor time management;

d) inadequate funding;

e) poor infrastructure; and

f) limited human resource.

4.4 Structured interviews

Ten structured interviews were successfully conducted in October 2019, out of the thirteen appointments made with a different set of respondents from the one used in the questionnaire survey. The structured interviews were conducted to enhance and verify the questionnaire results obtained. Participants in the interviews were drawn from academic institutions, research fund granting institutions, research institutions, government ministries and departments. The structured interview guide contained four sections as indicated below:

i.   Section A - personal information about the interviewee;
ii. Section B - managing research projects in research and academic institutions;
iii. Section C - implementation of project management techniques in research management ; and
iv. Section D - monitoring and evaluation of research projects

The complete interview guide is reproduced in Appendix B1. The results of the ten interviews are summarized in table 4.3.

4.4.1 Respondents profile

Table 4.1 presents the institutions where the participants were drawn from together with the categories they fall under.

Table 4.1:   List of institutions interviewed

Item	Name of Institution	Category
1	National Science and Technology Council (NSTC)	Research fund granting
2	Ministry of Higher Education	Government ministry
3	Lusaka Apex University	Academic Institution
4	Central Veterinary Research Institute	Research Institution
5	University Teaching Hospital – Women and Newborn Hospital	Academic Institution
6	Indaba Agricultural Policy Research Institute (IAPRI)	Research Institution
7	Zambia Institute for Policy Analysis and Research (ZIPAR)	Research Institution
8	Geological Survey	Research Institution
9	Directorate of National Science Center (Ministry of General Education)	Government department
10	Food and Drugs Control Laboratory	Government department

Table 4.2:   Respondent Experience and Expertise

R1	Respondent 1, Physiotherapist with 17 years of experience.
R2	Respondent 2 stated that the had vast experience in Ecology, research management, grant funding, scientific information collection and reporting
R3	Respondent 3 mentioned that they had a background in Vet. Immunology (PhD) with 21 years of experience.
R4	Respondent 4 summarized their experience by simply stating that they were a specialized Agronomist.
R5	Respondent 5 indicated that they were a Pediatrician and CEO for Women and Newborn Hospital. They were tasked with handling all approvals, and policies.
R6	According to Respondent 6, they stated that they were a Clinical pathologist with 16 years' experience with focus on Hematology, Clinical pathology and microbiology.
R7	Respondent 7 stated that they were a Geologist; specialized with administering research information regarding mineral and petroleum resources in the country.
R8	Respondent 8 reiterated that were specialized in Climate /mining and energy; financing of energy projects; public policy. The respondent was a Mechanical engineer with 8 years of sector experience.
R9	Respondent 9 was an Agriculture Economist focusing on environment/ natural resources and market development and trade.
R10	Respondent 10 stated that they were Mathematician by profession, with 27 years of experience.

4.4.2   Interview results

Table 4. 3 presents the results of the interviews conducted.

Table 4. 3:   Summary of structure interviews

Managing Research and Development (R&D) in Zambia	
Question	**Response**
From your experience, are you able to confirm whether research institutions in Zambia have policies or guidelines for managing research projects?	**YES:** Seven out of the 10 respondents confirmed that research institutions have policies and guidelines for managing research projects. Most of these pointed to the use of research and innovation policies, and ethics committee procedural guidelines, **NO**: On the other hand, a minor threshold of three out of ten respondents indicated that research institutions in Zambia did not have policies or guidelines for managing research projects.
From your experience, would be able to advise whether organizations involved in research and development are using project management techniques in research management?	**YES**: Five out of ten respondents on the study stated that 'Yes' organizations use PM techniques in research management. One respondent emphasized that 'for big projects in particular, this helps to run operations efficiently and ensure that due processes are followed, thereby ensuring that research is well conducted and completed on time. **NO**: Five out of ten respondents on the study said that organizations do not use PM techniques in their respective research management.
Implementation of Project Management (PM)	
Familiar PM tools used to manage research projects in organizations?	One respondent said that various tools were used for PM and these included; Time management, Cost management, Integration of projects. Risk assessment not done by most institutions. The next respondent emphasized that some major tools used were Risk analysis, and time/ weakness in follow ups. Another stated that tools used in many cases were; Time management, resource (funds) monitoring, and Human capital skills development.

	On the same question one respondent pointed out the use of risk mitigation tools such as Risk analysis and Gantt charts, to manage projects. Similarly, another respondent stated that risk management, and time management were some of the main tools used to manage projects with last one saying that most tools used to manage projects are the likes of database, risk analysis; cost analysis; scope management.
Major constraints to the successful implementation of project management techniques by research organizations in Zambia?	According to one respondent, the major constraints included the lack of PM skills by researchers. The other responses were as follows: a. bureaucracy, resistance from researchers, traditional heavy workload, does not accommodate PM for most researchers; b. a lack of PM training was a major constraint; c. a mindset aspect was a major constraint due to lack of appreciation of PM by researchers; d. weakness in translating research findings into practice, lack of deliberate policy, and working in silos; e. lack of dedicated PM and lack of adequate policy/frameworks; f. lack of clearly defined objectives, lack of PM skills, misplaced skills, and financial constraints; g. lack of basic PM knowledge is a constraint to be noted; h. lack of PM appreciation and lack of PM knowledge are constraints noted in PM; and i. lack of capacity in PM, and the diverse nature of activities/tasks involved in most projects were major constraints noted to the implementation of PM.
Question	**Response**
Identified Challenges that affect successful implementation of research projects.	
Finance	The financial related factors presented that could constraint successful implementation of research projects included the following: a. poor funding of private institutions as a major challenge; b. lack of financial management skills is a major challenge ; c. limited funding had proven to be a major hurdle; d. lack of funding was a major challenge for .
Time Management	With regard to time management the following were noted: a. non adherence to time was a major challenge; and b. misapplication of time by researchers.
Human Resource Expertise	One respondent stated that a poor work culture among project staff creates a challenge and the others added that; a. that a lack of PM knowledge also poses a challenge; b. lack of skilled manpower is also a potential PM challenge; and c. lack of appreciation for research being major challenge stemming from human resource skill.
Other	The other challenges identified besides the ones above included the following: a. lack of industry/academia relationship core challenge noted; b. focusing on non-demand driven research; political sensitivity was another challenge identified; c. access to data/information in Zambia, is a challenge on its own; and d. lack of stakeholder engagement and bureaucracy is a key challenge identified.
Monitoring and Evaluation
Monitoring and evaluation of	Five out of the ten respondents said academic and research institutions in Zambia

research projects	monitor research projects with three stating that they were not sure and one saying the academic and research institutions do not monitor research projects. One respondent said the monitoring and evaluation units are in place but not functional.
Notable weaknesses in the Research Management frameworks	On monitoring and evaluation, the following weaknesses were presented: a. lack of guidelines in the frameworks; b. tenets of research management have not been formalized and are not yet project oriented; c. lack of policy documents (always in draft) and poor leadership/organization structure; d. lack of supervision and logistical support, were major challenges in the M&E system; e. poor planning; f. research undertaken was not relevant; g. lack of funding; h. lack of incentives for conducting research; i. bureaucracy as the main challenges; and j. lack of specialists to implement certain tasks.
Suggestions for improving the performance and management of research projects in Zambia?	The respondents recommended a number of interventions to improve performance of research projects in Zambia. The suggestions included the following: a. need for more funding, need for training in PM tools and techniques, need for M&E, publishing of research reports; b. need to introduce Project Management, performance management and frameworks in research institutions; c. project proponents need to be introduced to PM skills before commencement of research; d. funding agencies need to develop key performance indicators; e. R&D institutions to strengthen research offices; f. need for research policies/guidelines; g. to encourage short term courses in PM/leadership; h. increased funding; i. and increased transparency in financial management of projects; j. need for harmonization of R&D criteria (guide on how to conduct R&D and also to strengthen M&E at all levels); k. deliberate policy to take into account applicability of results, feasibility, cost and other factors; l. sharing results, building consensus on the way forward, developing policy and thereafter, guidelines for implementing and monitoring the research projects; m. better supervision of research projects; need for M and E frameworks in institutions; strengthen the research structures; increased funding to research institutions; need for policies to appreciate research; n. effective planning; increased funding; necessary skills/infrastructure upgrade; appreciation of research; need to look at research as an economic activity/business activity; need for incentives; o. to give incentives to researchers; strengthening IP policies; capacity building/skills upgrade on IP; p. to appreciate and use PM techniques; balance focus on results as well as processes; decent knowledge of PM skills; and institutions should come up with PM frameworks; and q. to develop a national research agenda / database.

4.5 Summary

This chapter has elaborately presented and analysed the findings obtained from a sample of predominantly male academicians and researchers working in academic and research institutions with majority of them holding doctor of philosophy degrees and having more than ten years of experience. The study revealed that majority of the academic and research institutions in Zambia apply project management techniques in managing research projects. Further, the findings show that despite the majority of these institutions having guidelines or policies for managing research, their systems have weaknesses that may affect performance of research projects. The next chapter discusses the findings in detail.

CHAPTER FIVE: DISCUSSION OF THE RESULTS

5.1   Introduction

In the previous chapter, a detailed presentation and analysis of the results from the study was conducted in order to understand the extent of application of project management application in academic and research institutions in Zambia. The findings were based on the responses from researchers working in academic and research institutions in Zambia. This chapter presents the discussion of the findings drawn from the analysis of results from the questionnaire survey and structured interviews, respectively.

5.2   Research findings

The aim of the research was to determine whether academic and research institutions in Zambia were using project management techniques when managing research projects. This was achieved by obtaining and analyzing information from key stakeholders that implement and manage research projects in their respective academic and research institutions in the country. The findings obtained from the forty two questionnaire responses and the ten interviews have been discussed presented according to the presentation of the results.

5.2.1   Availability of policies and guidelines for managing research projects

The findings of this study clearly show that policies and guidelines for managing research projects are available in the majority of the academic and research institutions in Zambia. Both the questionnaire survey administered and structured interviews conducted confirm this result.

This result indicating the availability of policies and guidelines for managing research in academic and research institutions gives a positive indication that at organization level efforts have been made by the academic and research institutions to strategize on how to organize and manage the various research projects undertaken in these institutions. From the literature reviewed, it is seen that policies or guidelines are necessary for institutions as they provide organizations the means to improve their capabilities and performance in the delivery of a defined strategy (Bull, Shaw, and Baca, 2012). Ideally the guidelines or policies for research management would include modalities for the transfer of research results to the solution seekers, and therefore, the availability of these guidelines offers hope for application of science and

technology in Zambia. However, according to the Ministry of Science, Technology and Vocational Training (1996) the country did not effectively apply science and technology, therefore, contributing to the poor performance of industry, a situation that has resulted in industries becoming uncompetitive with declining productivity under global trade environment. The poor performance by industry is also reflected by the week manufacturing system with low levels of value addition to the country's raw materials (Zambia Association of Manufacturers Report, 2017).

From the above discussion it is noted that as much as it is cardinal to have well-defined policies or guidelines for managing an important activity like research, what is even more important is the implementation of these policies or guidelines. What is evident from the findings is that the study could not reveal much evidence of the implementation of these policies or guidelines. Taking the example of databases for research projects undertaken in a particular institution as proof of implementing the developed research guidelines or policies, less than half of the respondents confirmed that their institutions kept databases.

Therefore, the fact that institutions do have policies in place but cardinal activities like keeping data bases were not done, it indicates that the research management systems in these institutions require implementation plans for them to be of benefit.

Further, with the findings from the questionnaire survey indicating that the percentage of private institutions with policies or guidelines is higher than that for public universities, it suggests that public institutions may be affected more by bureaucracy and red tape in the development of such systems a challenge alluded to by some respondents in the study.

5.2.2   Application of project management techniques in research institutions

The findings from both the questionnaire survey and structured interviews, respectively, showing that more than half of the respondents said their institutions apply project management techniques, agree with the result under section 5.2.1 which says that majority of the respondents confirmed that their institutions have already developed policies or guidelines for managing research projects. This is because the application of project management techniques can be effectively done in an environment where established policies or guidelines are in place.

However, the findings from the questionnaire survey indicating that the percentage of public institutions that apply project management techniques was higher than those from the private sector does not agree with the findings under section 5.2.1 which shows that the percentage of private institutions having guidelines or policies was higher than the public institutions. This situation may be due to the fact that fewer (14 percent) private institutions participated in the study as compared to the public institutions and therefore, if more private institutions participated the result would have been different. Further, the result that only 58 percent of the respondents from the questionnaire survey, and half of the respondents interviewed agreed that their institutions applied project management techniques show that, the application of the project management techniques were not implemented to the desired levels with one reason being that the project management techniques were not fully integrated.

The study conducted by Roil and Thuiller (2015) revealed that research projects are project management compatible, considering certain structural similarities and a cultural acceptance of project management value. Therefore, with some respondents in the study suggesting that a mindset change by researchers is required so as to embrace project management and other complementary skills (section 4.3.6), it shows that acceptance of project management among researchers in Zambia may be low. Some examples pointed to the fact that institutions would apply project management techniques to big projects in particular and not small projects. This is because the implementers would assume that small research projects did not require application of project management techniques as the resources (time, personnel among others) to do certain activities were not readily available and that this would be a drain on the scarce institutional resources. However, for big projects, project management activities are usually budgeted for in order to help run operations efficiently as many funding agencies want to see value for their money. The funding organisations in these cases would ensure that due processes are followed and the relevant techniques are applied so that research is well conducted and completed on time with high chances of success.

Academic and research institutions in Zambia therefore, need to consider increasing the level of application of project management techniques as one way of enhancing the effectiveness of research management. This would lead to increased output from these institutions and therefore, assist to meet the aspirations of the 7 National Development Plans (7NDP).

5.2.3 Application of project management techniques by researchers

The data collected from the questionnaire survey indicates that the number of researchers who apply project management techniques when conducting research is equal to the number of researchers who do not apply project management techniques when conducting research. Further, as noted from section 4.3.4 the percentage of respondents that use project management techniques was higher in private institutions as compared to the public institutions.

The above findings, suggest that the level of application of project management techniques by individual researchers may not be as desired and therefore, require improving for effective research management as proposed in the 7 national Development Plan (Ministry of National Development Planning, 2017). This agrees with the presentation under 5.2.2. With the country identifying a number of challenges during the implementation of the 1996 National Science and Technology Policy as presented in the problem statement, it therefore, calls for the identification of ways in which research and development can be effectively conducted and application of project management techniques is one of the proposed interventions (Donna, 2017).

It can be seen from the results that the most commonly used project management knowledge areas are time and quality management, respectively, with majority of the respondents confirming that they use five out of the six time management activities provided and three out of three quality management activities presented. Most of the respondents were able to indicate how important it is to manage time and further gave examples of how they do that. The Gantt charts and time schedules were the most common examples. This result could be attributed to the fact that observing time is an inherent activity which may require specialized skills only in big and complex projects. Half of the respondents did not put coordination of research projects as a priority but expected the institutions they work for do that task. The main reason for this was that they would be too stretched if they combined these two tasks.

Managing risks associated with the research projects undertaken was not common with most respondents. From the five risk management activities presented, 51% of the respondents confirmed that they identified the project risks as a matter of practice but do not perform any of the other four activities which include risk management planning, qualitative risk analysis, risk response planning and risk monitoring and control. For demand driven research, the researchers

would be worry of risk of project failure and the associated financial implications. The intervention then is an active risk research management framework.

Managing project finances and scope of activities was also seen to be appreciated by many respondents to some extent. Majority of the respondents confirmed implementing two out of the three project cost management activities but only 40 percent of the respondents confirmed implementing cost control. The low levels of cost control can be attributed to low financial management skills by researchers as well as to the fact that researchers expect the accounts units of their institutions to perform the activity. For scope management, majority of the respondents used three out of the five scope control activities presented. Majority of the respondents however, said they did not control nor verify scope of the research projects during implementation. The result actually confirms the statement by Basu (2015) that research is unpredictable and this makes scope control challenging for the researcher.

The main reason attributed to the average knowledge and application of project management techniques by researchers when managing research is the inadequate project management skills by the researchers.

From literature Roil and Thuillier (2015) through their studies, confirmed that research projects are project management compatible considering certain structural similarities and a cultural acceptance of project management value. Dona (2017) further adds that implementation of project management techniques when managing research projects increases the effectiveness and efficiency of the research work leading to increased chances of success. The result that only 50 percent of the respondents apply project management techniques when managing research projects may suggest that the performance of research projects in the sampled institutions and indeed Zambia is not as desired. Further, this has an implication on the relationship between research/academia and industry. Because of this, industry is not likely to engage academic and research institutions in the country to research and develop means of adding value to the abundant raw materials Zambia is blessed with. This situation would not assist the country's aspirations to diversify the economy through industrialization and converting raw materials into finished goods.

5.2.4 Monitoring and evaluation of research projects

The findings from the questionnaire survey indicating that researchers and the research institutions they work for monitor and evaluate the research projects they implement was also confirmed during the structured interviews where seven out of the ten people who participated in the structured interviews said monitoring and evaluation was implemented in academic and research institutions. This result is despite that weak monitoring of research projects was identified as a challenge faced by the researchers as presented in section 4.3.6.

From the findings in chapter four, most respondents indicated that they measure project success by the project outcomes as well as the accomplishment of objectives. Fewer respondents indicated that they use financial impact as an indicator. The low level of consideration for the financial impact as a success factor by researchers agrees with the explanation in 4.2.3 that the academic and research institutions in Zambia most likely do not work closely with industry to conduct demand driven research. What is evident is that, focus for most research conducted in the country is on basic research which according to Kowalczyk (2013) is driven purely by curiosity and desire to expand our knowledge in a subject matter and therefore, no commercial application. If the country's focus was demand driven research funded by the private sector/industry, financial impact of the research could have been a factor in the research conducted.

From the results obtained, a deduction can be made that researchers in Zambia are conversant with monitoring and evaluation approaches. This is also supported by the results from 5.2.1 which confirm the availability of policies or frameworks to manage research in these institutions. It is expected that these policies or frameworks should contain the monitoring and evaluation methods.

5.2.5 Challenges in managing research projects

Implementation of research projects faces numerous challenges in Zambia. The structured interviews conducted clearly brought out these challenges with all the ten people interviewed confirming that researchers face a number of challenges when implementing research projects.

These challenges could be attributed to the respective academic and research institutions and also to the individual researchers.

The challenges presented under section 4.3.6   revolve around three key issues and these cut across all sectors. It is expected that research performance would be enhanced if these three issues are resolved.

1) National research agenda – the country seemly does not have a common document to guide research. This has led to a situation where policies or guidelines for academic and research institutions that have the capacity develop their own guidelines have been developed but these do not feed into a national strategy for research. As a result, these institutional policies or guidelines may fail to effectively contribute to the national development plans. The lack of a national research agenda has led to institutions working in 'silos' and because of this it is more likely that research efforts may be uncoordinated with the risk of duplication of efforts. Another result for lack of a national research agenda would be a situation where a certain institution lacking a particular piece of equipment fails to progress because they are not aware that another institution in the country has that equipment. It is expected that within the framework of this national research agenda, platforms for information sharing would exist.

2) Financing – This is an issue that was common to all participants in the study. Evidently, research in Zambia does not receive the desired funding neither from the national treasury nor from the private sector. Naturally, the little available financial resources from government are spread out to the government supported academic and research institutions like UNZA, CBU, NISIR, and ZARI among others. The said budget allocations do not suffice to fund any meaningful research. Industry which should be collaborating with research institutions and fund demand driven research does not do that in Zambia. This may be attributed to the fact that the majority of players in the private sector are foreign owned corporations who fund research in their countries of origin. Further, the Zambian academic and research institutions have not positioned themselves well to give confidence to these multinational corporations.

3) Training/skills and infrastructure – This aspect refers to skills in core disciplines and/ or complementary skills. The lack of project management and financial management skills explains this. For infrastructure, there are instances when researchers send samples outside

the country for testing and this may be due to either, because of working in 'silos' one institution does not know that another institution in the country has that particular piece of equipment or in the entire country no institution has that particular equipment. Further, research infrastructure in the country is outdated and require replacing/upgrading. The poor state of research infrastructure in the country does not give confidence to stakeholders.

To some extent the identified challenges faced when managing research projects could contribute and also be reasons for the non-optimal application of project management techniques in Zambia. It is clear that issues relating to financing can impact negatively on the application of project management techniques as some of these techniques require procuring. Some examples would be certain software, and training staff so as to upgrade skills. Considering that budget allocations are low, academic and research institutions may not prioritise these activities. A well-defined national research agenda would assist academic and research institutions to include at least the basic best practices of research management in their individual policies. With the established link between project management techniques and research performance, it therefore fits that application of project management techniques for improved research performance could be one of these basic practices.

In order to ensure that quality research is conducted, a lot of effort has to be made. Clearly, with the whole list of challenges presented and the three key issues outlined, it becomes difficult to attract funding for demand driven research from industry by the academic and research institutions. The results obtained in this study give an indication of the magnitude of the problems faced by academic and research institutions. However, it should be noted that solving these challenges require commitment and effort by the researchers, academic and research institutions, industry and the government. Otherwise if the status quo is left as is, the country will continue to export raw materials and to import finished goods.

5.2.6   Identified weaknesses in the research project management frameworks

Research management frameworks used to manage research in academic and research institutions in Zambia have weaknesses. The findings of this study clearly show that 60 percent of the respondents in the questionnaire survey said they identified weaknesses in research management frameworks and 37 percent of the respondents said they did not find any weaknesses. 3 percent of the respondents did not respond to this question. The structured

interviews confirmed the results of the questionnaire survey with seven out of ten saying there are weaknesses in the research management frameworks found in academic and research institutions in Zambia. As much as the results in 5.4.1 show that academic and research institutions in Zambia do have policies or guidelines for managing research, the average feedback of 50 percent in 5.2.3 agrees with the findings that majority of the sample for both the questionnaire survey and structured interviews said there are weaknesses in the research frameworks.

In a number of situations, what is apparent is that the developed frameworks are not in use and therefore serve no purpose. These weaknesses tend to affect the performance and therefore, quality of research in the academic and research institutions. The situation if left unchecked may lead to the growing lack of confidence in these institutions by various stakeholders. Key issues relating to weak research frameworks can be identified.

1) Monitoring and evaluation systems may not be consistent with the aspirations of various stakeholders. The results show that most respondents indicated that their institutions have monitoring and evaluation systems, but the results also suggest that these current monitoring approaches may not be as desired by the researchers as this has been identified by many respondents as a major weakness. A most likely case is of developed monitoring guidelines that are not being followed. This calls for an implementation plan to make use of these monitoring guidelines.

2) Guidelines and frameworks for managing research appear not to be institutionalized or they might not have been tailored well to suite the particular institutions. From section 5.2.1 it is noted that majority of the respondents confirmed that the academic and research institutions they work for have the guidelines for managing research project, however, there is an identified weakness associated with these frameworks/guidelines.

The above two issues are not the only weaknesses identified in the study. It is also important to acknowledge that, since research projects lends from other support units of these academic and research institutions, any inefficiencies in these support units could affect the performance of research projects. From the responses obtained, the following weaknesses associated with the support units were noted:

    i.   bureaucracy in the procurement process;

ii.   poor project governance resulting into poor risk management;

iii.   irregular disbursement of the project funds;

iv.   research management not being prioritized; and

v.   Lack of incentives for conducting research due to low appreciation by the other units.

5.3   Summary

This chapter discussed the data collected and findings on the application of project management techniques in academic and research institutions in Zambia. The majority of academic and research institutions in Zambia have policies or guidelines for managing research and also apply project management techniques when managing research. However, individual researchers have not adopted the project management techniques as would be expected with only 50 percent of them applying these techniques in their work. The next chapter concludes the report of the study and proposes recommendations for improving the performance of research projects and how project management techniques can be adapted to improve managing of research projects.

CHAPTER SIX: CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1   Introduction

The previous section discussed the results of the study undertaken in order to determine whether research institutions in Zambia apply project management techniques when managing research projects. The chapter also articulated the findings on the extent to which researchers in Zambia apply project management techniques when managing research projects, further identified the challenges the research institutions face and the weaknesses in the research management frameworks of these institutions. This chapter presents the conclusions drawn from the analysis of results from the questionnaire survey and structured interviews. In addition, it presents recommendations directed at improving the performance of research projects in academic and research institutions in Zambia. This section further highlights limitations regarding the study.

6.2   Conclusions

By considering the literature on project management and its application to research, and by employing the descriptive research design, the study found out that the majority of academic and research institutions in Zambia apply project management techniques in research management. The findings on the specific objectives are presented in the sub sections that follow.

6.2.1   Frameworks for managing research projects in academic and research institutions

This study has established that the majority of academic and research institutions in Zambia do have frameworks in form of guidelines or policies for managing research and that these institutions apply project management techniques when managing research projects. However, the implementation of the policies or guidelines may be unsatisfactory as evidenced by the findings indicating that the majority of the academic and research institutions did not keep databases of the research activities undertaken. Further, the findings indicate that the level of application of the project management techniques was not as desired with only 58 percent of the respondents from the questionnaire survey and 50 percent from the structured interviews agreeing that their institutions apply project management techniques.

6.2.2 Application of project management techniques by researchers

The findings from the study suggest that to some extent researchers in Zambia apply project management techniques when managing research projects. The study has also shown that the extent of application of project management techniques by the individual researchers is relatively lower than the extent to which the respective institutions do this.

6.2.3 Impediments to the successful implementation of research projects

Implementation of research projects is characterized with a number of challenges. The challenges faced by researchers and institutions when managing research projects can be grouped into four as follows:

a) lack of a national research agenda which leads to fragmented efforts;

b) lack of financing for research activities;

c) poor research infrastructure; and

d) lack of complementary skills.

6.2.4 Measures to curb the potential impediments to the successful performance

The study proposed a number of measures aimed at curbing the potential impediments to the successful performance of research projects in Zambia. The suggested measures can be grouped as follows;

a) Finalise/implement the national research agenda and strengthening institutional research policies/guidelines

b) Enhance training in complementary skills like project management and monitoring and evaluation; a mindset change among researchers,

c) Need to improve research infrastructure in the country, and

d) Increase funding to research activities.

6.3   Recommendations

Considering the identified impediments to the successful implementation of research projects in Zambia and the weaknesses of the project management frameworks in academic and research institutions, the following recommendations are made:

a) adoption of the suggestions under 6.3.4 by academic and research institutions, researchers, and the Government; and

b) adapting agile methods of project management to research management by researchers and the respective academic and research institutions in the country.

6.4   Study limitations

Though the study objectives were met as presented above, some limitations were encountered in the process. Some of these limitations and difficulties encountered in the study were as follows;

i.   literature on project management application in research management in Zambia was not readily available which made it difficult to have reliable data to benchmark the findings;

ii.   since the questionnaires were self-administered, the understanding and interpretation of the questions by the respondents was varied and therefore, accuracy of the findings could have been influenced;

iii.   Some respondents did not complete answering all the questions in the questionnaires thereby, affecting the accuracy of the results ; and

iv.   the sample was limited to Lusaka, copperbelt and central provinces leaving out the other parts of the country. This could distort the results of the study.

The study determined whether academic and research institutions in Zambia apply project management techniques, but more detailed studies are recommended in order to develop a model for the adaptation of project management techniques when managing research.

6.5   Summary

The majority of academic and research institutions in Zambia apply project management techniques in the management of research projects they implement. However, in most of these institutions, the research management frameworks have weaknesses that may affect the performance of research projects. Therefore, for improved performance of research projects, there is need to review the research management frameworks, policies and guidelines in institutions that have them and also develop these in institutions that do not have. Increased levels of project management application would also further improve research performance.

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APPENDICES

APPENDIX A: QUESTIONNAIRE SURVEY

A.1   Institutions and participants in the questionnaire survey

S/No.	Institution	Quantity
1	Agriculture Science - UNZA	2
2	Engineering - UNZA	2
3	Mines - UNZA	3
4	Medicine - UNZA	1
5	Natural Science - UNZA	3
6	Veterinary medicine - UNZA	4
7	Institute of Economic and Social Research (INERSOR)	4
8	Tropical Disease Research Centre (TDRC)	1
9	Zambia Agricultural Research Institute (ZARI)	2
10	National Institute for Scientific and Industrial Research (NISIR)	3
11	Central Veterinary Research Institute (CVRI)	3
12	Centre for Infectious Disease Research in Zambia (CIDERZ)	2
13	Mulungushi University	2
14	Cavendish University	2
15	Malaria Control Centre	1
16	SADC Plant Genetic Resources Centre (SPGRC)	1
17	Lusaka Apex Medical University	2
18	Copperbelt University (CBU)	3
19	Zambia Medicines Regulatory Agency (ZAMRA)	1
	Total	**42**

School of Engineering

Department of Civil and Environmental Engineering

University of Zambia, Lusaka

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: **INTRODUCTORY LETTER – MR. INNOCENT MANDONA, COMPUTER NUMBER 2017014766**

This serves to introduce **Mr. Innocent Mandona** – computer number **2017014766**. He is a postgraduate student at the University of Zambia pursuing the Master of Engineering degree in Project Management.

He is currently researching on his dissertation titled "**Project Management Application in Academic and Research Institutions in Zambia**". It is for this reason that we write to you to kindly assist Mr. Mandona with information and data to enable him successfully carryout and complete his research.

The department commits itself to have the information used strictly for educational research purposes only and be kept confidential within the department. Your assistance will be highly appreciated.

Yours faithfully,

Dr. Balimu Mwiya

HEAD – CIVIL AND ENVIRONMENTAL ENGINEERING

A.3 Questionnaire

Section A: General information on respondent

1. Respondent Gender   Male ( )   Female   ( )

2. Respondent Age   …………………………………………………………………………

3. Respondent Qualifications ………………………………………………………………

4. Name of Organization/Institution? ………………………………………………………

5. Years of work experience in the organization   …………………………………………

6. Academic Title of Respondent   …………………………………………………………….

7. Date ……………………………………………………………………………………………..

Section B: General information about the organization

8. Does your organization have a policy or guidelines on how to manage research projects?

 Yes ( )   No ( )   Not sure ( )

9. Does your organization have a register or database system on research projects undertaken?

Yes ( )   No ( )   Not Sure ( )

10. Are research projects assessed in your organization based on the following?

    a) Outcomes?   Yes ( )   No ( )   Not sure ( )
    b) Financial impact?   Yes ( )   No ( )   Not sure ( )
    c) Accomplishment of the objectives? Yes ( )   No ( )   Not sure ( )
    d) Other (please specify below)

……………………………………………………………………………………………………
……………………..
....

Section C: Implementation of Project Management Techniques in Research Management

11. Do you use any project management techniques in research management in your organization?

Yes ( )   No ( )   Not sure ( )

 If Yes to the question above please answer the following questions:

12. Which of the following '**Project time management** techniques' do you use when managing your research activities? Tick all applicable.

    a) Definition of research activities   ( )
    b) Sequencing of research activities   ( )
    c) Estimation of activity resources   ( )
    d) Duration estimation   ( )
    e) Schedule development   ( )
    f) Schedule control   ( )
    g) Other, specify   …………………………………………………………………

13. Which of the following '**Project cost management** techniques' do you use when managing your research activities? Tick all applicable.

    a) Cost estimating   ( )
    b) Cost budgeting   ( )
    c) Cost control   ( )
    d) Other, specify   …………………………………………………………………

14. Which of the following '**Project risk management techniques'** do you use when managing your research activities? Tick all applicable.

    a) Risk management planning   ( )
    b) Risk identification   ( )
    c) Qualitative risk analysis   ( )
    d) Quantitative risk analysis   ( )
    e) Risk response planning   ( )
    f) Risk monitoring and control   ( )
    g) Other, specify   …………………………………………………………………

15. How do you coordinate your research activities? Tick all applicable.

    a) By developing a charter   ( )
    b) Developing scope statement   ( )
    c) Research management plan   ( )
    d) Direct research project execution   ( )

e) Monitor and control project work ( )
f) Scope changes control ( )
g) Other, specify …………………………………………………………………

16. How do you develop the scope for your research work? Tick all applicable.

a) Scope Planning ( )
b) Defining scope ( )
c) Work Breakdown Structure (WBS) ( )
d) Scope Verification ( )
e) Scope Control ( )
f) Other, specify …………………………………………………………………

17. How do you ensure quality of your research work/activities?

a) Quality planning ( )
b) Quality assurance ( )
c) Quality control ( )
d) Other, specify …………………………………………………………

18. What are the major constraints (if any) to the successful implementation of the above project management techniques?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Section D: Monitoring and Evaluation of Research Projects

19. How do you and your organization monitor the effectiveness of research project management implementation?

a) Results based monitoring ( )
b) Activity based monitoring ( )
c) Other, specify …………………………………………………………

…………………………………………………………………………………………..

20. Have you identified any weaknesses in the research management framework? Yes ( ) No ( )

If Yes, please specify the weaknesses identified…………………………………………………..

……………………………………………………………………………………………………

……………………………………………………………………………………………………

21. Suggest ways of improving the performance and management of research projects.

……

……

……

THE END OF THE INTERVIEW

THANK YOU VERY MUCH FOR YOUR VALUABLE TIME!!!

If you have any comments or suggestions not only about this interview, please write below:

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

A.4   Consent form

THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES
NATURAL AND APPLIED SCIENCES RESEARCH ETHICS COMMITTEE

Telephone:	+260-211-290258/293937	P O Box 32379
Fax:	+260-211-290258/293937	Lusaka,
Zambia		
E-mail	drgs@unza.zm	

PARTICIPANT INFORMATION SHEET

This informed consent form is for researchers working in academic/research institutions as well as research managers in the academic institutions as well as research granting organisations.

Name of Principle Investigator: Innocent Mandona

Name of Organization: University of Zambia

Name of Sponsor: Self sponsored

This Informed Consent Form has two parts:

> • Information Sheet (to share information about the study with you)

> • Certificate of Consent (for signatures if you choose to participate)

> You will be given a copy of the full Informed Consent Form

Part I: Information Sheet

Introduction

My name is Innocent Mandona, a final year Master of Engineering student from the University of Zambia. I am carrying out a study on Project management application in academic institutions in Zambia. I am kindly asking you to participate in this study by answering the interview questions or /filling in the questionnaire whichever is applicable.

You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research. This consent form may contain words that you do not understand. Please ask me to clarify any part of the questionnaire and I will take time to explain.

Purpose of the research

The purpose of the study is to determine whether, research organizations in Zambia are using project management techniques in managing research projects, identify the potential impediments to successful project management application and performance in research management and to suggest the most important elements needed to improve project management performance in academic research and organization project management.

Type of Research Intervention

If you decide to participate you will be expected to provide information via a questionnaire or respond to questions during the interview. It is expected that this will take about 60 minutes to fill the questionnaire and if you participate in the interview it will take about 30 minutes.

Participant Selection

You are being invited to take part in this study because of your experience in conducting research activities and therefore, can provide valuable information to assist in this research.

Voluntary Participation

Participation in this study is voluntary. If you decide not to participate in this study, your decision will not affect any future relationship with you or your institution. If you choose to participate, you are free to withdraw your consent and to discontinue participation without penalty.

Procedures

A. Provide a brief introduction to the format of the research study.

We are asking you to help us learn more about the way you manage research activities you are involved in. If you accept to take part of this research project you will be asked to fill in a questionnaire that contains different questions.

B. Explain the type of questions that the participants are likely to be asked in the focus group, the interviews, or the survey. If the research involves questions or discussion which may be sensitive or potentially cause embarrassment, inform the participant of this.

You may answer the questionnaire yourself, or it can be read to you and you can say out loud the answer you want me to write down.

There are three different types of questions:

   a) General information about your self
   b) General information about the organization / academic institution you work for.
   c) Implementation of Project Management Techniques in Research Management
   d) How you monitor and Evaluate research projects

The questionnaire contains both multiple choice questions and open ended questions. If you do not wish to answer any of the questions included in the survey, you may skip them and move on to the next question. The information recorded is confidential, your name is not being included on the forms, only a number will identify you, and no one else except the researcher will have access to your survey.

Duration

The research takes place over one month in total. During that time you will be visited once for interviewing and each interview will take at least one (01) hour.

Uses of information

The information we shall get from you will be used to make recommendations on how best project management techniques can be incorporated in research management projects for quick results and efficient resource utilisation.

Risks

The study does not impose any foreseeable risks on the participants as the activity will be undertaken in the comfort of their work premises or offices.

Benefits

Your participation does not come with any personal benefit apart from the benefits that will accrue to the public by adding to the body of knowledge implementing project management techniques in the management of research projects and further propose future research in line with the findings of this study.

Reimbursements

You will not be provided any incentive to take part in the research. The interview will be conducted at your office and therefore, do not envisage any travel costs on your part. We however, appreciate your time.

Confidentiality

Any information that is obtained in the study that can be identified with you will not be disclosed without your permission. Names and any other identification will not be asked for in the questionnaires.

Sharing the Results

Nothing that you tell us today will be shared with anybody outside the research team, and nothing will be attributed to you by name. The knowledge that we get from this research will be shared with you before it is made widely available to the public. Each participant will receive a summary of the results. Following the above we will publish the results so that other interested people may learn from the research.

Right to Refuse or Withdraw

You do not have to take part in this research if you do not wish to do so. You may stop participating in the interview at any time that you wish. I will give you an opportunity at the end of the interview/discussion to review your remarks, and you can ask to modify or remove portions of those,

if you do not agree with my notes or if I did not understand you correctly.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact me:

Mr. Innocent Mandona

Tel: +260 954117432

Email: innocentmandona@yahoo.com

This proposal or protocol has been reviewed and approved by NASREC which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the IRB, contact:

Dr. Erasmus Mwanaumo Chairperson, Natural and Applied Sciences, Research Ethics Committee,

        University of Zambia

        P O Box 32379

        LUSAKA

        OR

 Professor Henry M. Sichingabula Director, Directorate of Research and Graduate Studies

        University of Zambia

        P O Box 32379

        LUSAKA

State if also it has been reviewed by a primary ethics committee by indicating an organization which may have reviewed the proposal. This primary ethics committee may be another university's ethics committee or a REC or IRB in another country) or an organization which is funding/sponsoring/supporting the study. Having granted ethical approval by a primary ethics committee in another country does not preclude obtaining ethics approval in a study country.

"Approval to conduct this research has been provided by the University of Zambia, in accordance with its ethics review and approval procedures. Any person considering participation in this research project, or agreeing to participate, may raise any questions or issues with the researchers at any time.

In addition, if you are/ or any person is not satisfied with the response of researchers may raise ethics issues or concerns, and may make any complaints about this research project by contacting the HSSREC on the address sated above.

All research participants are entitled to retain a copy of any Participant Information Form and/or Participant Consent Form relating to this research project."

Part II: Certificate of Informed Consent

(This section is mandatory)

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Print Name of Participant_____

Signature of Participant _____

Date _____

       Day/month/year

If illiterate [1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

---

[1] A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

Print name of witness_____   **Thumb print of participant**

Signature of witness   _____

Date _____

        Day/month/year

If vulnerable or incapacitated like pregnant women, children, people with mental illness, people with disabilities, prisoners and minority groups form instance, the investigator must ensure that there is a well-educated and motivated surrogate or proxy decision maker. When comprehension is an issue the research plan should include means of testing the participants' understanding of the important information prior to enrollment.

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Print Name of Researcher/person taking the consent_____

Signature of Researcher /person taking the consent_____

Date _____

        Day/month/year

CONTACTS FOR QUESTIONS (Names, addresses and phone numbers of the following):

1.   **Principal Investigator (Must be a local person and a Zambian).**

      Names: Innocent Mandona

      Phone: +260 954117432

      E mail: innocentmandona@yahoo.com

      Physical address: National Technology Business Centre, 8th Floor – New Government complex, Nasser Road, Kamwala, Lusaka.

A.5   Distribution of respondents qualifications per institution

S/No.	Institution	PhD	Masters	Prof
1	Agriculture Science	2		
2	Engineering	1	1	
3	Mines	3		1
4	Medicine	1		1
5	Natural Science	3		
6	Veterinary medicine	4		1
7	Institute of Economic and Social Research (INERSOR)	2	2	
8	Tropical Disease Research Centre (TDRC)	1		
9	Zambia Agricultural Research Institute (ZARI)	1	1	
10	National Institute for Scientific and Industrial Research (NISIR)	3		
11	Central Veterinary Research Institute (CVRI)	1	2	
12	Centre for Infectious Disease Research in Zambia (CIDERZ)	1	1	
13	Mulungushi University	1	1	
14	Cavendish University		2	
15	Malaria Control Centre	1		
16	SADC Plant Genetic Resources Centre (SPGRC)		1	
17	Lusaka Apex Medical University		2	
18	Copperbelt University (CBU)	3		1
19	Zambia Medicines Regulatory Agency (ZAMRA)		1	

A.6   Distribution of respondent's years of experience

Institution	1 - 5 Yrs.	6 -10 Yrs.	11 – 15 Yrs.	16 -20 Yrs.	21 – 25 Yrs.	26 -30 Yrs.	31 & above	Total
Cavendish University	0	0	1	0	0	1	0	2
National Malaria Control Centre	0	1	0	0	0	0	0	1
Tropical Disease Research Centre (TDRC)	0	1	0	0	0	0	0	1
SADC Plant Genetic Resources Centre (SPGRC)	0	0	1	0	0	0	0	1
Zambia Medicine Regulatory Authority	0	1	0	0	0	0	0	1
The Copperbelt University	0	0	2	1	0	0	0	3
Mulungushi University	0	2	0	0	0	0	0	2
Institute of Economic and Social Research (INESOR) – UNZA	0	3	1	0	0	0	0	4
UNZA - School of Medicine	0	0	0	1	0	0	0	1
UNZA - School of Mines	0	2	0	0	0	0	1	3
UNZA - School of Veterinary Medicine	0	0	1	1	2	0	0	4
UNZA - School of Natural Sciences	0	0	1	0	1	1	0	3
UNZA - School of Agriculture	0	0	1	1	0	0	0	2
UNZA - School of Engineering	0	0	0	2	0	0	0	2
Zambia Agriculture Research Institute	0	0	1	0	0	1	0	2
National Institute of Scientific and Industrial Research	0	0	2	1	0	0	0	3
Central Vet Research System	0	0	2	0	1	0	0	3
Lusaka Apex Medical University	2	0	0	0	0	0	0	2
Centre for Infectious Disease Research in Zambia (CIDRZ)	2	0	0	0	0	0	0	2
Total	4	10	13	7	4	3	1	42

APPENDIX B: Structured interview guide

B.1   Structured interview guide

This interview guide is designed to gain more insight on the Project Management application in academic/research institutions in Zambia and to gather respondent perception on various aspects of the project such as, the different project management frameworks used in managing research in Zambia, the challenges faced and recommendations. The interview questions are very brief, so feel free to provide as much information as possible.

Section A: Personal Information

1. Gender   Male   ( )   Female   ( )

2. Age   …………………………………………………………………………………………….

3. Job title   …………………………………………………………………………………...

4. Name of Organization/Institution? …………………………………………………………....

5. I would like to know your background in brief

 ……………………………………………………………………………………………………..
…………………………………………………………………………………………………

Section B: Managing Research Projects in Research and Academic Institutions

6. From your experience, are you able to confirm whether research institutions in Zambia have policies or guidelines for managing research projects?

 Yes ( )   No ( )   Not sure (   )

If yes, give examples …………………………………………………………………………

7. Do you know of any institution that has a register or database system on research projects undertaken to date?

Yes ( )   No ( )   Not Sure (   )

If yes, give examples…………………………………………………………………………..

8. From your experience, would be able to advise whether organisations involved in research and development are using project management techniques in research management?

Yes (   )   No (   )   Not sure (   )

If yes, explain …………………………………………………………………………………..

……………………………………………………………………………………………………...

Section C: Implementation of Project Management Techniques in Research Management

9. What project management processes and tools, if any, do staff in the organisations you are familiar with use to manage research projects?

……

………………………………………………………………………………………………………...

10. What is the most common basis for assessing research projects in research and development institutions that you are aware of being implemented by researchers/institutions?

    h) Outcome based   (   )
    i) Financial impact   (   )
    j) Accomplishment of objectives   (   )
    k) Other, specify …………………………………………………………………..

11. In your opinion, what would you consider to be the major constraints to the successful implementation of project management techniques by research organisations in Zambia?

……

……

12. What challenges have you identified that could affect successful implementation of research projects?

……

……

Section D: Monitoring and Evaluation of Research Projects

13. Do you think researchers and organisations in Zambia monitor implementation of their research projects?

   Yes (   )   No (   )   Not sure (   )

14. If the answer is yes in 13, what would you regard to be the most commonly used monitoring and evaluation techniques in managing research projects by research organisations?

d) Results based monitoring　　　　　　( )
e) Activity based monitoring　　　　　　( )
f) Other, specify　　　　　……………………………………………………………………………

………..

15. From your experience, have you identified any weaknesses in the research management frameworks used by institutions you are familiar with?

Yes ( ) No ( )

If Yes, would you point out some notable weaknesses in the research management frameworks you are familiar with ……………………………………………………………………………….

……

16. Do you have any suggestions for improving the performance and management of research projects in Zambia?

………...

………...

………...

………...

……….

THE END OF THE INTERVIEW

THANK YOU VERY MUCH FOR YOUR VALUABLE TIME!!!