Project Management Application in Academic and Research Institutions in 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 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*

Introduction

Research and Development is the vehicle by which organizations and economies create opportunity, innovation and secure a stream of future products and services. 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). Research projects are fundamentally unpredictable and therefore require effective management (Basu, 2015). Basu (2015) further states that this unpredictability of research could arise because research projects may experience unplanned scope changes and in a number of instances goals may not be clearly defined. However, research projects could be efficiently and effectively implemented by adapting project management techniques (Donna, 2017). Further, the adaption of these techniques to research projects means that the research project schedule, cost, and scope must be balanced whist ensuring quality (Donna, 2017).

Project implementation may be constrained in a number of ways and this has potential to prevent a project from achieving its goals (Gray & Larson, 2018). With the foregoing, it becomes imperative that effective constraint identification and management is conducted and a look-ahead schedule (aligned to the overall project strategy) is defined for successful project execution. Further, for successful project implementation, it is important to ensure that the project plan remains on track by monitoring and controlling the various activities. Monitoring and controlling of project activities also assists the project team or research institution to assess the performance of the respective project management systems.

The Project Management Institute (PMI, 2017) defines project management as the application of knowledge, skills, tools, and techniques to project activities in order to meet project needs. Project management, therefore, focuses on achieving set goals or delivering a product within a defined timeframe and budget allocation. This attribute makes project management an important tool for many organisations whose business is to deliver a service or product that meets customer expectations. According to Gray & Larson (2018) application of project management in a number of organisations does not yield the desired results and this may be due to the fact that these organisations do not tailor the best practices to suit their needs but merely replicate them. Project management ultimately has three functions; planning, executing and controlling (Gray & Larson, 2018).

Statement of the Problem

According to the Zambia Association of Manufacturers Report (2017) the country continues to export raw materials more than it exports finished products—a situation which may signal that Zambia does not add value to its natural resources to the desired levels, and that this may be due to the lack of capacity to do so. This capacity can only be enhanced when academia improves its research performance resulting in improved academia and industry collaboration where industry funds demand driven research and development. Further, the majority of sector interventions in Zambia were being implemented without a coherent and harmonized policy framework.

Aim of the Study

The study sought to determine the extent to which academic and research institutions in Zambia apply project management techniques when implementing research projects. This is because it was not known the extent to which research institutions in Zambia implemented project management techniques. The study makes recommendations on how performance of research projects could be improved.

The main aim of the study was to determine whether research organizations in Zambia were using project management techniques in managing research projects in order to improve performance of these research projects.

Objectives

The study aim was achieved by satisfying the following objectives:

i. establishing the level of project management knowledge among researchers and academicians;

ii. determining the extent of application of project management techniques in research and academic institutions;

iii. ascertaining how the research management frameworks in research and academic institutions were performing; and

iv. identifying the potential impediments to the successful performance of research projects in Zambia.

Literature Review

Overview of Project Management

Literature proposes that the concept of project management has been around for a long time and can be traced to the earliest human activities. Project management has enabled people to plan bold and massive projects and manage funding, materials and labor within a designated time frame (Barron & Barron, 2011). According to the Project Management Institute (2017) a project is a temporary endeavor undertaken to produce a unique product, service or result. Projects ideally have certain characteristics that differentiate them from other endeavors and research activities subscribe to these (Gray & Larson, 2018).

Project management ultimately balances the demands placed on duration, available finances and the defined scope of activities whilst ensuring quality (see Figure 1). The project schedule, available funding and scope of activities which are referred to as the triple constraints are therefore cardinal to the project's performance as compared to the other project demands. Balancing the triple constraints is one of the primary functions of project management.

Figure 1: Project Management Triple Constraints

While time is usually the limiting factor in industry, the uncertain funding environment in academic and research institutions may constrain projects more (Donna, 2017). Further, in a number of cases, it has been observed that the triple constraints of time, cost and scope have not been adequately balanced, and this has led to compromised quality and performance of research projects (Donna, 2017).

According to Barron and Barron (2011) every project has a beginning, a middle period and an end period with four phases of initiation, planning, execution and closure. Activities in the middle period move the project toward completion which may either be successful or unsuccessful. The project phases are collectively called the project life cycle as they represent the path a project takes from the beginning to its end (PMI, 2017). Gray and Larson (2018) further state that the uniqueness of project work is better illustrated using the project life cycle. Some project managers use the project life cycle as the cornerstone for managing projects because it assists them to predict the changes in the level of effort and to focus over the life of the project. During the life of a project the start point is marked when the project gets the necessary approval. Initially efforts are low but build to a peak, and then decline towards closure of the project. It has been noted that different models for lifecycles exist and these are industry specific. Figure 2 shows a typical project life cycle.

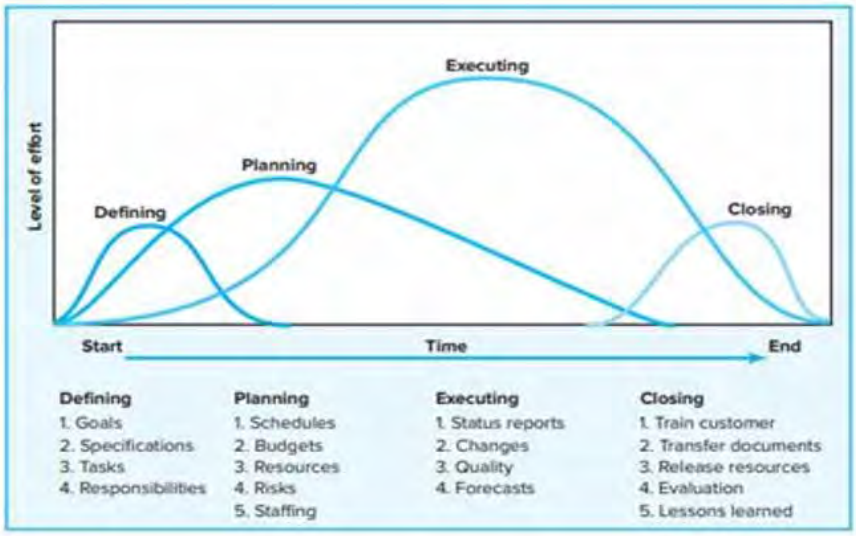

Figure 2: Project Life Cycle

The first stage in the cycle is referred to as 'Defining'. Project definition involves outlining the specifications of the project, establishing objectives, forming teams and assigning responsibilities. The following stage is known as 'Planning'. During planning the level of effort increases, and plans are developed to determine what the project will entail, when it will be scheduled, whom it will benefit, what quality level should be maintained, and what the budget should include. The next stage is referred to as 'Executing'. During this phase major portions of the project work takes place. Physical products such as bridges, reports or software programs are produced during this phase, as are the project schedule, project cost together with the specification measures being used for monitoring and controlling the project. There are various factors 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 parameters and the required revisions/changes (Gray & Larson, 2018). The last phase referred to as 'Closing' phase is characterised by the handing over of the product to the customer. The other activities under this phase include redeploying project resources, and conducting the post project review.

Project life cycles are used by project teams to time activities over the entire life of the project. As an example, planning for commitment of resources could be done in the defining stage while the quality aspects could be planned for the later stages of the life cycle (Barron & Barron, 2011). Gray and Larson (2018) further say, considering that a number organisations run many projects at the same time and that these may be at different stages of the life cycle, the coordination units

requires careful planning and management for these projects to be implemented successfully.

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 (PMI, 2018). The Project Management Institute has developed arguably the most important project management standard which it has named 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 of tools and techniques for managing projects are unique to project management (IEEE, 2009).

However, understanding and applying the above described best practices alone may not be sufficient for effective project management (Project Management Institute, 2017). According to Johnson (2013), to be the most effective, project managers need to have a balance of general management skills, technical management skills and project management skills. To support this, Taylor (2006) 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. (p. 2)

Barron and Barron (2011) summarise the foregoing in Table 1.

Table 1 Project Management Areas of Expertise

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

In order to ensure a project's success, there are a number of models a particular project could adopt and there are also certain essential processes that should be present in almost all of these models (Oxbridge Academy, 2019). Essentially, there are about 47 identifiable processes categorized into five groups, namely: initiating, planning, executing, monitoring and control, and closing (PMI, 2017). Every project management process produces one or more outputs (deliverable or outcome) from one or more inputs by using appropriate project management tools and techniques (PMI, 2017).

The project processes can also be categorized by knowledge areas (KA's), which are categories of concepts and processes with a common goal (Harrin, 2019). These knowledge areas are categorised into ten as given below:

1. Integration – Coordinates activities across all project management areas and process groups;
2. Scope – Ensures that the project work includes all elements required to complete the work;
3. Schedule – Ensures that the project work is completed in a timely way;
4. Cost – Plans, estimates, manages and controls project finances;
5. Quality – Ensures that the project delivers a quality output that is fit for purpose;
6. Human Resource – Secures, manages and monitors use of human resources throughout the project;
7. Communications – Ensures that communications on the project are planned and carried out appropriately;
8. Risk – Identifies, assesses and manages risk;
9. Procurement - Carries out purchasing and contracting as required; and
10. Stakeholder – Identifies and engages stakeholders throughout the project.

From the above categorisation, it is seen that process groups are the chronological phases that the project goes through, and knowledge areas occur throughout the time of the process groups. The process groups are horizontal, and the knowledge areas are vertical (Hartney, 2016). It is the collection of the process groups and the knowledge areas that, when tailored and applied to a particular project, ensure success and are therefore key project management techniques.

Different types of project management systems have been developed to satisfy the specific needs of organisations or types of projects (LaBarre, 2019). Some of these methodologies are given below:

1. 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. The steps in this type are linear and progress flows in one direction (LaBarre, 2019).
2. Agile Project Management - This is best suited for incremental and iterative projects and usually involves processes with demands and solutions evolving through the collaborative effort of self-organizing and cross-functional teams and their customers (Muslihat, 2018).

3. Lean Project Management - This methodology aims to avoid waste and borrows heavily from the Japanese manufacturing practices. The main thrust of this method is creating more value for customers with fewer resources (LaBarre, 2019).
4. Scrum Project Management - The main goal for scrum project management is developing, delivering, and sustaining complex outputs through collaborative, accountable, and iterative progress and is best suited for projects teams of less than seven members who require a flexible approach to delivering a product or service (Muslihat, 2018).
5. Kanban Project Management - This is a visual method that uses the agile framework and aims to deliver high quality results by depicting the workflow process so that bottlenecks could be identified early on in the development process. It is ideal for lean project teams that require a flexible approach to delivering the output and is best suited for personal productivity purposes (Muslihat, 2018).
6. Six Sigma Project Management - This method aims to improve quality by reducing the number of errors in a process by identifying what may not be working and then removing it from the process. The method employs empirical and statistical quality management methods, and expertise of people who are specialists in these methods. The method is best suited for larger companies and organizations that aim to improve quality and efficiency through a data-driven methodology (Muslihat, 2018).
7. Project Management Body of Knowledge (PMBOK) – This is a set of standard terminology and guidelines for project management and not a methodology per se. PMBOK gives five process groups (initiating, planning, executing, monitoring & control, and closing) that are prevalent in almost every project (PMI, 2018).

Besides the ones listed above, there are many other types of project managements systems and methodologies.

Application of Project Management Techniques to Research Projects

Academic research faces new methods of knowledge generation that trigger a need for managing research projects effectively (Riol & Thuiller, 2015). Therefore, the methodologies outlined above together with the project management processes and knowledge areas can positively impact research projects when they are well tailored and applied. Johnson (2013) said project management came out of engineering practice and has been adapted to many fields since. Riol and Thuiller (2015) 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. Riol and Thuiller thus developed a prescriptive framework for facilitating PM implementation in academic research at the institutional, organisational and operational levels.

The compatibility confirmed by Riol 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, with the so-called push toward a western-style knowledge economy (Rinne & Koivula, 2005; Holliday, 2012). Therefore, research outcomes have a significant impact both directly and indirectly on an institution's 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).

According to the Science Business Society Dialogue Conference (Academy of Science of South Africa, 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" (p. 3).

In the Zambia Association of Manufacturers 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" (p. 6). 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. In Zambia, the research community has appreciable potential that could be harnessed by industry for sustainable economic development.

However, this desired relationship between industry and the research community may not flourish, 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. 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 at higher prices, thereby earning the country more revenue. Recognizing that knowledge is reliably acquired through conduct of research, it is therefore, important that the research process be well managed. The techniques of project management may be utilized to achieve this.

Methodology

Research Design

This study employed descriptive research in trying to establish whether researchers and research institutions in Zambia were using project management techniques in implementing their work. This type of research design involves observing and describing the behavior of the sample without influencing and explaining it in any way (Shuttleworth, 2008). The study, therefore, did not focus on answering questions about how/when/why academic institutions do or do not apply project management techniques (Shields & Rangarajan, 2013).

Target Population and Sample Size

Forty-two out of the 50 targeted respondents participated in the study. These respondents were drawn from universities and research and development institutions. These institutions were selected for their relevance to the study and because they fit in the time frame and resources of the researcher. Consent was obtained from the 42 respondents who participated in the study before they could answer the self-administered questionnaires. The sample size subscribed to Mosco's rule of the thumb which states that a minimum sample of 30 respondents is sufficient (Sekaran, 2000). Further, the opinion of ten researchers, government ministries and research granting institutions was sought in the study to confirm/provide explanations regarding the respondent's feedback through structured interviews.

Sampling Methods

The sampling technique employed was purposive sampling. This type of sampling employs non-probability techniques where subjects are selected because of their convenient accessibility and proximity to the researcher and importance for the study. This technique was preferred because it is fast, inexpensive, easy and the subjects were readily available (Cooper & Schindler, 2001).

A representative sample was selected in order to obtain more scientific results that could be used to characterise 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.

Data Collection

Questionnaire surveys and structured interviews, respectively, were the two methods used to collect primary data during the study. Questionnaires were chosen because they were easy to administer and could be distributed simultaneously thereby saving time (Mugenda & Mugenda, 2003). The participants in the self-administered questionnaires were assured of anonymity and explained 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 were 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 questionnaires contained closed-ended as well as open-ended questions and was divided into four sections. Section A sought to get general information about the respondents who participated in the study; the information collected and used to profile the respondents included gender, age, qualifications, years of experience, and institutions the respondents worked for. The information helped to confirm reliability of the data collected. Section B contained questions related to the research or academic institution the respondents worked for; the questions sought to determine whether the academic and research institutions had already developed policies or guidelines for managing research, what performance assessment criteria the institutions used, and whether these institutions kept databases for the research projects undertaken. Section C discussed project management techniques and processes employed by researchers and the institutions they worked

for; the questions asked related to the project management knowledge areas of Integration Management, Time Management, Cost Management, Risk Management, Scope Management, and Quality Management. Section D focused on monitoring and evaluation of research projects.

Ten structured interviews were successfully conducted out of the 13 appointments made. 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:

Section A - personal information about the interviewee;

Section B - managing research projects in research and academic institutions;

Section C - implementation of project management techniques in research management; and

Section D - monitoring and evaluation of research projects

Methods of Data Analysis

The study employed a combination of qualitative and quantitative methods, respectively of data analysis and approach in order to analyse the obtained results. Data obtained from the field was in raw form and therefore difficult to interpret unless it was cleaned, coded and analyzed (Mugenda & Mugenda, 2003).

In this study, qualitative data obtained from the open-ended questions in the questionnaires and interviews, respectively, was analyzed descriptively. This data was summarized and organized by grouping it into meaningful patterns and themes that were observed.

Quantitative analysis was also used to analyse the quantitative data collected from closed-ended questions 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 to aid in data coding, data entry and analysis of the quantitative data

Results and Discussion

The study involved ten structured interviews and 42 questionnaire responses, respectively. The study had representation from institutions in Zambia that conduct research. The respondents to the questionnaire survey included experienced researchers with 67% of them having more than ten years' experience as shown in Figure 3.

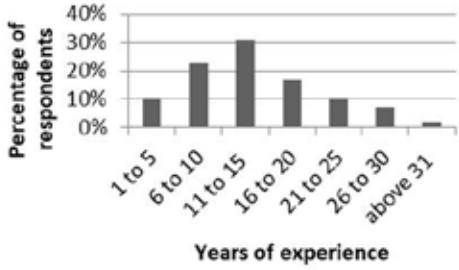

Figure 3: Percentage distribution of respondents' experience in conducting research

In Figure 4 it is seen that majority of the respondents were PhD holders with 33% of the respondents being master's degree holders. The distribution by gender: 83% of the respondents were males and 17% females.

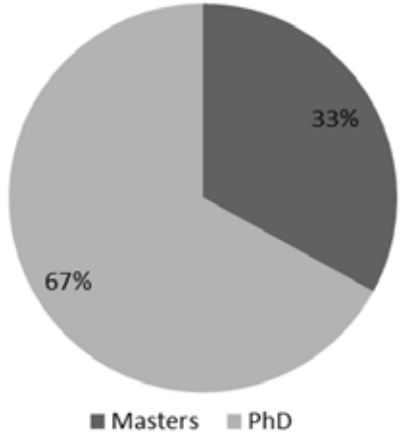

Figure 4: Percentage distribution of respondents' academic qualifications

The feedback from the structured interviews was in agreement with the questionnaire survey responses even if the two guides were structured differently so as to answer the research questions. The questionnaire survey and structured interview questions aimed to collect information that would help determine the extent to which researchers and the institutions they work for implemented project management techniques when managing research projects; the challenges faced by these institutions when trying to adapt project management techniques and the challenges faced when conducting research projects in general. The results of the study were discussed as outlined below:

- availability of policies and guidelines for managing research projects;
- application of project management techniques in research institutions;
- application of project management techniques by researchers;
- monitoring and evaluation of research projects;
- challenges in managing research projects; and
- identified weaknesses in the research project management frameworks.

Availability of Policies and Guidelines for Managing Research Projects

The findings 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 and structured interviews confirm this result. From the questionnaire survey, 62% of the respondents confirmed that their institutions had the policies or guidelines for managing research, 19% of the respondents indicated that their institutions did not have these documents, and the remaining 19% of the respondents were not sure whether their institutions had these policies/guidelines or not. From the structured interviews, six participants confirmed existence of policies or guidelines in academic and research institutions, three participants answered in the negative and one was not sure whether academic and research institutions have these policies or guidelines.

The availability of policies and guidelines for managing research in academic and research institutions was supported through examples given of the various institutions that had them, both from the public and private sectors, respectively, such as the University of Zambia (UNZA), Copperbelt University (CBU) and Cavendish University among others. It was also established that among the academic institutions only UNZA and CBU have within their structures directorates for guiding research in their respective institutions, and that the other institutions spread out these functions to the respective faculties or departments. Further, it was confirmed that from the list of academic and research institutions sampled, only UNZA and CBU have intellectual property (IP) policies that offer guidance on how intellectual property rights and therefore, proceeds of research, ought to be handled. The other institutions in the study did not have IP policies, or at best these were in draft form.

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, only 40 % of the participants confirmed that their institutions kept databases for the research projects undertaken in the past. Thirty-one percent said their institutions did not have databases of research projects and 29% were not sure whether their institutions kept the databases or not.

This data was obtained by using closed-ended questions in both the questionnaire survey and the structured interviews and the quantitative data analysed statistically using Statistical Package for Social Sciences (SPSS).

The findings of the study, therefore, confirm that the majority of the research institutions had policies or guidelines for managing research projects but these policies or guidelines were probably not being utilized much in most of these institutions that had them. Combining the two results indicate that the research management systems in these institutions require implementation plans for them to be of benefit. Further, the participation of private institutions was noted to be low which shows that private institutions conduct research to a lesser extent as compared to public funded institutions. This may mean that most of the private institutions do not have policies or guidelines for managing research. One explanation for the low levels of research activities in privately run institutions may be the lack of resources to formulate these policies or guidelines and to conduct the research itself. For the public institutions the policies or guidelines in a number of instances were developed with assistance from government facilitated collaborations with donor agencies. The private sector, however, did not befit from this kind of support.

Application of Project Management Techniques in Research Institutions

The findings clearly show that academic and research institutions in Zambia apply project management techniques when managing research projects. Figure 5 shows that 58% of the respondents confirmed that their institutions apply project management techniques; 21% said their institutions do not apply the project management techniques and the remainder of the respondents said they were not sure whether their institutions applied the project management techniques or not.

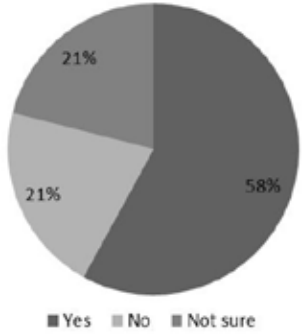

Figure 5: Percentage distribution of organizations' usage of project management techniques

The quantitative data on the application of project management techniques in academic and research institutions was collected through closed-ended questions in the questionnaires. Further, the structured interviews were used to collect qualitative information on the same topic. The qualitative information obtained through explanations agreed with the frequency counts of the questionnaire survey.

The findings in Figure 5 reiterate that the majority of the respondents confirmed their institutions have already developed policies or guidelines for managing research projects. This is because application of project management techniques can best be done in an environment where established policies or guidelines are in place. Further, the structured interview results showed that 50% of the respondents agreed that the research institutions they are familiar with use project management techniques in research management. There was an indication that the application of the project management techniques was not implemented to the desired levels with one reason being that the project management techniques were not fully integrated. 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.

Application of Project Management Techniques by Researchers

Figure 6 shows that the researcher's knowledge and application of project management techniques when managing research is average. The data collected 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.

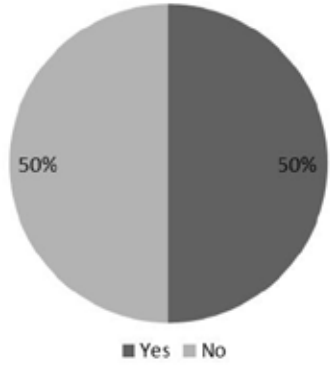

Figure 6: Percentage distribution of researchers' usage of project management techniques

The results revealed that the most commonly used project management knowledge areas are time and quality management, respectively, with the 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. This situation may be typical of basic research projects. For demand driven research, the researchers would worry of the risk of project failure and the associated financial implications. The intervention then is an active risk research management framework.

Managing the project finances and scope of activities was also seen to be appreciated by many respondents to some extent. The majority of the respondents confirmed implementing two out of the three project cost management activities but only 40% 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, the majority of respondents used three out of the five scope control activities presented. The majority of 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 of the researchers.

This data was collected through the survey questionnaire administered and this process was followed by the structured interviews in order to confirm the questionnaire results. The questionnaire method was preferred in this study because it was able to cover the major aspects of project management knowledge areas and processes as well as to reach many researchers in the different locations at low cost. The 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. The quantitative data collected from the closed-ended questions was analysed and presented through the use of statistical techniques which included frequency counts, pie charts and bar charts.

From the literature Riol and Thuillier (2015) confirmed that research projects are project management compatible considering certain structural similarities and a cultural acceptance of project management value. Donna (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. That only 50% 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.

Monitoring and Evaluation of Research Projects

With regard to monitoring and evaluation, the study revealed that 82% of the respondents indicated that they used 'results-based project monitoring' to assess effectiveness of the research work and 59% indicated the use of the 'activity-based monitoring approach.' This result from the survey questionnaires was also confirmed during the structured interviews where seven out of the ten participants said monitoring and evaluation was implemented in academic and research institutions. With results-based monitoring and activity-based monitoring being the major approaches cited, there was also an indication that researchers would at times mix the two approaches when monitoring the research activities.

Regardless of the approach used to monitor research projects, it is important to identify an indicator for measuring the project success. The findings indicated that 73% of the researchers said their institutions look at outcomes of the research projects to determine success and 68% of the researchers said that besides the outcomes they also look at meeting the objectives of the research projects. What is interesting to note is that only 32% of the researchers pointed to financial impact being a factor, with 27 % saying financial impact is not a factor and 41% not sure whether financial impact is a factor or not.

The low level of consideration for the financial impact as a success factor by researchers agrees with the explanation given earlier 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 not 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.

Closed-ended questions were used to collect the information on monitoring and evaluation in both the survey questionnaires and the structured interviews. This feedback gave quantitative data which was analysed using statistical methods. Further, the questions had an option for specifying other answers. It was from this that qualitative feedback was drawn.

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 to the individual researchers. The challenges identified 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 seemingly 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 few available financial resources from government are spread out to the government-supported academic and research institutions like UNZA, CBU, National Institute for Scientific and Industrial Research (NISIR), and Zambia Agricultural Research Institute (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 requires 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 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 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.

The structured interview guide contained open ended questions used to collect qualitative feedback on challenges faced by researchers when managing research projects as well as when applying project management techniques to research. This qualitative data collected was analysed using qualitative techniques. The data collection and analysis employed in this study has brought out key and valid issues that could not be obtained from closed-ended questions.

In order to ensure that quality research is conducted, considerable effort must 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 requires 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.

Identified Weaknesses in the Research Project Management Frameworks

Figure 7 shows that 60% of the respondents in the questionnaire survey said they identified weaknesses in research management frameworks and 37% of the respondents said they did not find any weaknesses. Three percent 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 earlier results show that academic and research institutions in Zambia do have policies or guidelines for managing research, the average feedback of 50% individual researchers having knowledge and applying project management techniques agrees with the findings that the majority of the samples for both the questionnaire survey and structured interviews said there are weaknesses in the research frameworks.

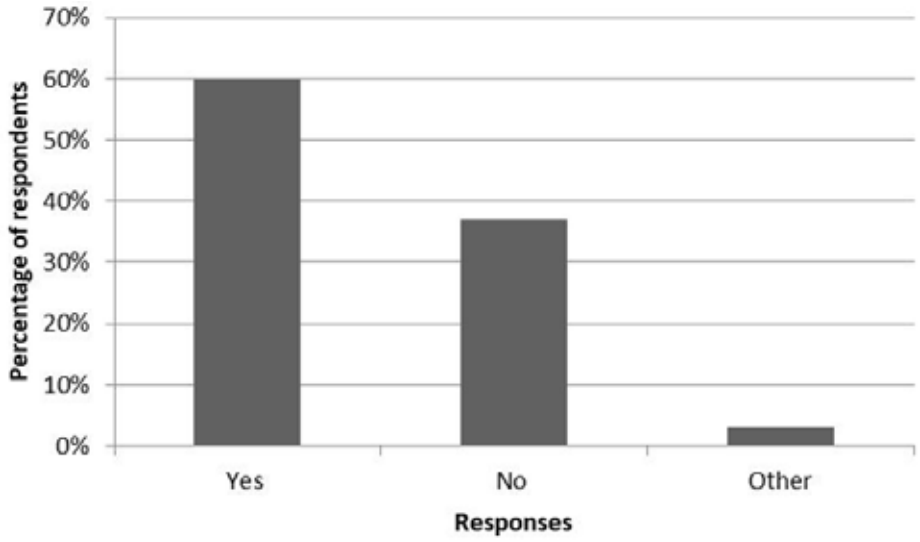

Figure 7: Weakness in research management framework response rate

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. Two 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 suit the particular institutions.

The above two issues are not the only weaknesses identified in the study. It is also important to acknowledge that, since research projects depend on 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:

- bureaucracy in the procurement process;
- poor project governance resulting in poor risk management;
- irregular disbursement of the project funds;
- research management not being prioritized; and
- lack of incentives for conducting research due to low appreciation by the other units.

Both open-ended and closed-ended questions in the structured interviews as well as the questionnaire survey were used to arrive at these findings. The data obtained, therefore, was both quantitative and qualitative. The qualitatively obtained data from the open-ended questions provided explained the identified weaknesses.

Conclusions and Recommendations

In this era where knowledge is the cornerstone for economic development, the search for new knowledge through research and development is vital (Cantner et al., 2008). Various studies have shown that research performance can be improved by adapting project management techniques (Riol & Thuiller, 2015). Therefore, this study aimed to determine whether research institutions in Zambia were using project management techniques in managing research projects. The aim was achieved by obtaining and analyzing information from key stakeholders that implement research projects in the respective academic and research institutions in Zambia.

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 as follows.

Application of Project Management Techniques in Research Institutions - This study has established that the majority of the academic and research institutions in Zambia apply project management techniques when managing research projects. Further, the study revealed that these institutions have policies or guidelines for managing research. The findings agree with the findings of the studies conducted by Riol and Thuiller (2015) which showed that in order to successfully implement project management techniques to research projects, there is need for well-defined guidelines or policies.

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 to which individual researchers apply project management techniques is relatively lower than the extent to which the respective institutions do this. These findings agree with the presentation by Johnson (2013) that not all scientists have the ability to comply with institutional research guidelines which may include the requirement to adapt traditional project management techniques.

Performance of Research Management Frameworks - The majority of academic and research institutions in Zambia have weaknesses in the respective research management frameworks. These weaknesses can negatively affect the performance of research projects. The study has also shown that the majority of the academic and research institutions do monitor the research projects implemented and that the results-based approach is used more than the activity-based approach. Further, these institutions tend to use the project outcomes as the measure of success for the projects rather than the research meeting the objectives. The identified weaknesses broadly cover the following areas:

- policies or guidelines not being effectively utilized by researchers for various reasons;
- dilapidated and in some instances lack of research infrastructure;
- financing for research being inadequate;
- complementary skills like project management techniques lacking;
- focus on non-demand driven research;
- collaboration between industry and academia is low; and
- poor work culture.

Challenges in Managing Research Projects - The challenges faced by researchers and institutions when managing research projects can be grouped as follows:

- lack of a national research agenda which leads to fragmented efforts;
- lack of financing for research activities;
- poor research infrastructure; and
- lack of complementary skills

Recommendations

Having understood the weaknesses of the respective project management frameworks and the challenges faced by researchers when implementing research projects, the study yielded the following recommendations aimed at enhancing the performance of research projects in academic and research institutions in Zambia:

3. Develop a national research agenda to guide and harmonise the conduct of research and development. (The document is currently in draft form.)
4. Enhance the project management skills of researchers in research institutions through tailored courses by funders and the research institutions.
5. Strengthen research management frameworks in research institutions.
6. Encourage a mindset change by researchers to embrace techniques aimed at improving research management.
7. Improve monitoring and evaluation frameworks by research institutions.

Further Research

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.

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