AN INVESTIGATION OF FACTORS CAUSING SCHEDULE OVERRUN IN TELECOMMUNICATION PROJECTS IN ZAMBIA

By

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I hereby declare that the work presented in this thesis is the result of my research work and that it has not previously been submitted for a degree, diploma or other qualification at this or another University.

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APPROVAL

This dissertation of Epheso Sibalwa is approved as fulfilling in the partial requirements for the award of the Degree of Masters of Engineering in Project Management by the University of Zambia.

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ABSTRACT

The aim of this research was to investigate the causes of time overrun in the telecommunication projects in Zambia. To achieve this goal a multi-mode descriptive study was adopted by using both qualitative and quantitative approaches. A detailed literature review was done and sixteen purposively sampled project managers and subject matter experts (SME) were interviewed to obtain expert judgement on the factors affecting time management. The thirty-four factors identified from the interviews were categorised into five generic causes using the fishbone diagram framework: Process, Management, Equipment, People and Environmental factors. A questionnaire containing thirty-four identified delay factors was distributed to the rest of the professionals from network operators, equipment vendors, contractors, telecommunication infrastructure support companies, involved in telecommunication projects with a response rate of seventy-eight percent obtained.

From the results, the eight highest ranked factors were identified with the highest frequency of occurrence and impact on the schedule. Most of the interviewed experts pointed to poor planning as the main cause of project schedule overrun, affecting subsequent project phases. Based on the fishbone framework, it was found that process-related factors were the major contributors to project delays. These results highlight the need for telecommunication network operators to improve the time management processes, considering the emerging trends of outsourced model of operations.

Keywords: Root cause analysis, schedule overrun, telecommunication projects, time management, Zambia

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ACRONYMS

2G	Second Generation of mobile telephone technology
3G	Third Generation of mobile telephone technology
4G LTE	Fourth Generation Long Term Evolution mobile telephone technology
BSC	Base Station Controller
FI	Frequency Index
FII	Factor Importance Index
GGSN	Gateway GPRS Support Node
GSM	Global System for Mobile Communications
ICT	Information and Communication Technology
MNO	Mobile Network Operator
MSC	Mobile Switching Centre
RAN	Radio Access Network
RCA	Root Cause Analysis
SGSN	Serving GPRS Support Node
SI	Severity Index
UMTS	Universal Mobile Telecommunications System
ZICTA	Zambia Information and Communication Technology Authority

CHAPTER 1 : INTRODUCTION

1.1 Introduction

As the Information and Communication Technology (ICT) industry experiences ongoing rapid changes due to its exponential subscription growth, efficient project delivery remains one of the key factors for the operators' competitive advantage. Managing projects in the telecommunication industry requires ability and excellent knowledge of project management. Successful projects start with a good quality project schedule. However, like any other type of project, telecommunication project managers are faced with challenges of finishing the projects within schedule. Project managers have to manage and control work execution while wave-rolling planning projects, analyzing new constraints and requirements, compressing time and costs. ICT project management is further complicated by the shifting business and customer needs and demanding stakeholders of traditional organizations (Sherif, 2006).

Telecommunication projects involve the deployment and integration of the infrastructure into the existing network and/or the provisioning of the services to the end users. It is a multi-disciplinary and cross-functional endeavour that combines engineering and business skills within a regulatory framework (Sherif, 2006). A typical telecommunication deployment process requires experts from a number of different disciplines, including design, materials procurement, equipment installation, equipment integration and testing, tuning and optimisation. Figure 1.1, adapted from Orchestra Technology (2017), shows the process used in radio access network (RAN) deployment.

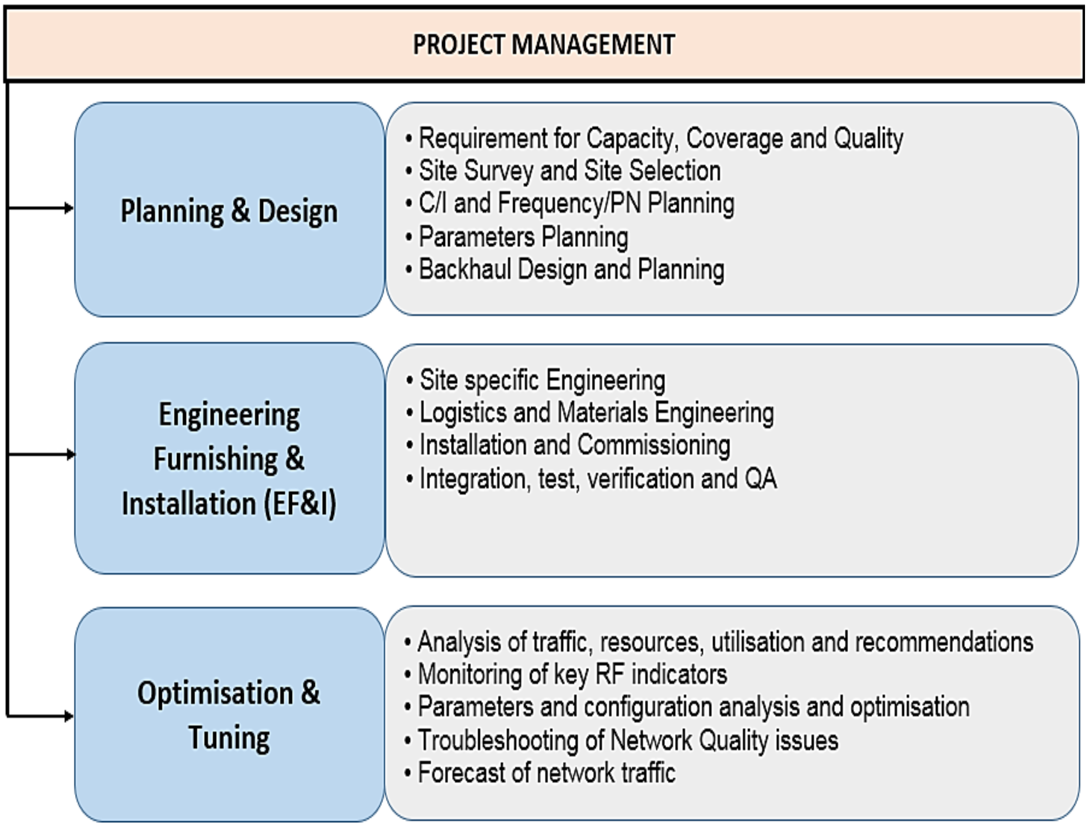


Figure 1.1: Radio Access Network Deployment Process

Source: Adapted from Orchestra Technology (2017)

1.2 The telecommunication industry in Zambia

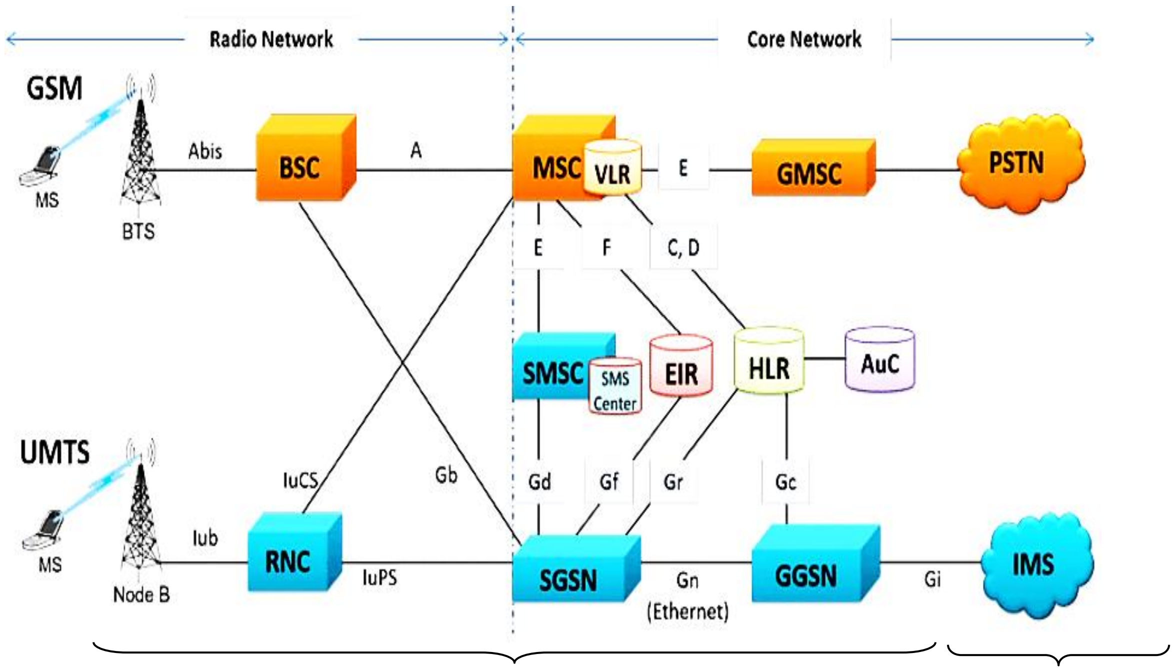
The mobile telecommunication industry is one of the fastest growing and continually changing markets in Zambia. There has been a tremendous upsurge in mobile cellular subscription since early 2000 from fifty thousand to more than ten million while mobile internet usage has increased from four hundred thousand in 2011 to more than three million by third quarter (Q3) 2014 (ZICTA, 2015). Network operators are under constant pressure to meet the data-hungry needs of their subscribers. This explosion of data usage among subscribers is forcing mobile operators to accelerate their network deployment plans to keep up with coverage and capacity demands by upgrading and expanding their networks or adopting strategies aimed at remaining competitive in the industry. There has been a constant evolution of the networks from second generation (2G), third generation (3G) to long term evolution (4G LTE), with intermediary technologies, to meet the data usage demands of customers.

The telecommunication industry has reached maturity stage in its cycle and the focus has changed from strong subscriber and revenue growth to profit protection and efficiency optimization (Frisanco, 2010, pp. 763-776). Network operators are placing more emphasis on efficiency throughout the life cycle of the product. The multiplicity of choices at each level of the service hierarchy has made the interaction among vendors, sponsors, and customers extremely complex making efficiency and timely delivery of the final product key to competitive advantage (Sherif, 2006). The telecommunication industry is both dynamic and capital intensive. The technology is changing rapidly - user requirements are diverse and constantly changing, product life cycles have become very short, and the windows of opportunity that exist for companies to achieve the benefits of the technology have been shortened. Due to these dynamics, competitor network operators have been forced to cooperate and adopt shared service business models, sharing transport and site infrastructure.

Like most of the mobile telecommunications companies globally, network operators in Zambia have diversified their networks of equipment suppliers. Diversification means that most of the projects span across different suppliers, each supplier having its own methodology and documentation. Even for a standard interface, the documentation and terminology can be different from vendor to vendor. Most of the projects involve working with multiple suppliers and integrating the work done by them, since an average mobile telecommunications project will impact more than one system. The pressure to deliver the project in the shortest possible time, with higher quality and with lower cost, meeting high and dynamic customer expectation has resulted in mobile telecommunications companies and vendors around the world adopting various project management and operations methodologies that best suit their project requirements. In order to improve efficiency in service delivery, the industry has seen adoption of outsourced and managed service models as the best practice. Equipment vendors, who are assumed to possess specialised expertise and competence, now predominantly carry out project delivery.

A mobile telecommunication network infrastructure is a combination of numerous network elements that are required to support voice, data or video services. A basic network comprises the radio and core networks, as shown in Figure 1.2. Different interfaces exist to interconnect the individual nodes within the network, and also to interconnect with other networks and the Internet. Telecommunication project management, therefore, involves the management of projects in the distinct functionality, the whole network and/or involving other networks where the operator has little control on the project execution.

Network operators have to become innovative and more adept at how they adopt and implement technology to be able to launch a product or service in the market on time and ahead of competitors. If a company decides to adopt a particular technology but spends too much time on any stage of the project life cycle, the benefits of adoption might never be realized.



Network Operator Control Other Providers

Figure 1.2: Mobile Network Architecture
Source: QUALCOMM Incorporated (**2006**)

1.3 Rationale

Project schedule overruns have been experienced across all types of ICT projects, with varying degrees of frequency and impact on the project. As pointed out by Le-Hoai *et al.* (2013), time overrun is a common problem that is experienced by the infrastructure development industry globally. Akinsiku and Akinsulire (2012) also observed that project delay is a persistent phenomenon in construction project delivery and it is branded as the most common, costly and risky problem encountered in infrastructure development projects with a debilitating effect on the parties to a contract. The findings of the study carried out by Azis, Memon & Rahman (2012) revealed that 92% of construction projects were overrun and only 8% of projects could achieve completion within contract duration. According to the report by Budzier & Flyvbjerg (2011, pp. 1-25), large ICT projects in the UK were found to be twenty times more likely to 'run out of control' than other large infrastructure projects and one in six projects reported an average cost overrun of 200% and a time overrun of almost 70%. In Zambia, the turn-key Universal Access project was initially scheduled to run from October 2013 to October 2014 (ZICTA, 2015), but the project was not completed by end of 2015. A similar observation has been made in private network operators, even though no data has been made public about the project performance.

Various studies have been carried out to examine the possible factors that lead to time overruns, in order to avert the associated losses of failure to meet the initial project requirements. However, most of these have focused on the construction industry with little research specific to telecommunication projects. Sherif (2006) argues that while telecommunication projects have similarities with construction projects, there is a significant difference between the two. The rapid growth and frequent changes of telecommunication sector, with continual introduction of new technologies and usage patterns, make it difficult to use the methods of analysis and forecasting applicable to the physical infrastructures. The ICT sector is mostly commercially driven and has a strong international dimension and dependence, which further increases the complexity of analysis (Sherif, 2006). While ICT projects have a lot of similarities with construction projects, they have specific characteristics e.g. their unique risks, the rapid development requirements to meet rush-to-market demands, the short life of technology, and multiple dependencies with other projects (Taylor, 2004, p. 2). So even if tools are the same, they must be applied differently depending on the project type and complexity.

Table 1.1 highlights some of the general characteristics and differences of ICT and non-ICT projects as discussed by Taylor (2004, pp. 1-3)

Table 1.1: ICT vs. Non-ICT Projects Characteristics

Project Component	Non-ICT Projects	ICT Projects
Project	Not integrated with most business functions	Linked with business and organization systems
Project Structure	Often stand alone	Multiple projects with numerous interdependencies
Scope	Well defined	Less defined and subject to change
Change Control	Well defined	Definable change control process, but more difficult to track
Stakeholders	Fewer; Easier to identify	More; More difficult to identify
Resources	Full-time	Usually part-time; skill set used as task progress dictates
Staffing	Best people in critical skill sets; more generalists	Best people available; mostly specialists
Large Projects	Divided by organization or established standalone units	Allocated by specialty across organizational lines
Risks	More easily identified; poorly managed but usually with less negative impact	Not easily identified; poorly managed with high project / organizational impacts
Documentation	Poor to fair	Moderately good, but poorly applied
Lessons Learned	Poor to fair	Poor
Budget & Schedule Estimation	Good	Poor

Source: Adapted from Taylor (2004)

The foregoing highlights the extent of the problem faced by the telecommunication industry in general, and the challenges experienced in applying the generic project management principles. Even if there is scarce documented information on the telecommunication projects performance in Zambia, the same trends are being observed. Therefore, the research aimed at systematically identifying and evaluating the real causes of project schedule overruns, by adopting a holistic approach on the industry. By determining the real causes for the delay, the research provided empirical data for stakeholders to be able to correlate the problems and apply remedies that do not only treat effects but root causes of the problem. The dissertation, therefore, provides valuable information for policy makers, used in decision making and project control.

1.4 Research Aim and Objectives

1.4.1 Aim

The aim of this research was to investigate factors causing schedule slippages in mobile telecommunication projects in Zambia. This will give information required to develop a project management framework that could be used to systematically enhance time management.

1.4.2 Objectives

To achieve the aim, the following objectives were devised and studied:

i. Establish factors that lead to schedule slippage in mobile telecommunication projects;
ii. Categorise delay factors in mobile telecommunication projects;
iii. Evaluate the impact of the delay factors and rank them according to their importance as perceived by the stakeholders; and
iv. Recommend appropriate measures that can be adopted in mobile telecommunication project management to minimize or control schedule slippage

1.5 Research Questions

The research questions for this study are:

- What are the causes of time overruns on mobile telecommunication projects in Zambia?

1.6 Scope of the Study

The scope of this research project is limited to time management in mobile telecommunication projects in the Zambia. The regulatory authority (ZICTA), mobile network operators, vendors, contractors and infrastructure support companies in the mobile telecommunications industry provided the information for the research. The data for this study was gathered through literature review of the relevant articles, interviews and questionnaire survey. The interview respondents were based in Lusaka, where decision makers and project managers are based, while the questionnaire survey targeted the rest of the telecommunication professionals across Zambia.

1.7 Research Methodology

A multi-mode research methodology was adopted after identifying the existing gap on the root cause of project schedule slippages. By using both qualitative and quantitative methods, a better and deeper understanding of the root causes of delays was obtained. Primary data collection was done using interviews as the tool for qualitative data collection, while a questionnaire survey was used for quantitative data. For secondary data collection, literature review of studies done by previous researchers was done. Purposive and stratified sampling were used for qualitative and quantitative methods respectively, targeting professionals from mobile network operators, equipment vendors, infrastructure support companies and the regulatory authority that are involved in projects. The collected data was analysed using Excel and Statistical Package for Social Sciences (SPSS).

1.8 Limitations and assumptions of the study

The researcher faced challenges during the study and the report should be considered with some limitations in mind.

- The study focused on telecommunication projects in Zambia from a holistic point of view. The findings might vary from one project type to the other e.g. infrastructure vs services deployment projects or radio vs core projects. However, the basic principles certainly encompass all forms of telecommunication projects.
- Little documented information exists on the performance of the telecommunication projects, as there are few studies done in Zambian ICT industry and most of the operators consider such information confidential. The identification of the problem was based on the observation and informal discussion by the researcher with project stakeholders.
- The assumption made when collecting data was that all respondents have a fair knowledge of the subject and gave their responses objectively.

1.9 Research Organization and Chapter Overview

The background, objectives and justification to the research problem are contained in Chapter 1. Literature review of previous researchers on project time management, and causes of schedule slippage is undertaken in Chapter 2. Chapter 3 describes in detail the methodology followed in this research study, with justification on the method adopted for the study. Results of the research, with analysis, are presented in Chapter 4. Chapter 5 provides the conclusions and recommendations derived from the results.

Figure 1.3 summarises the organization of the report.

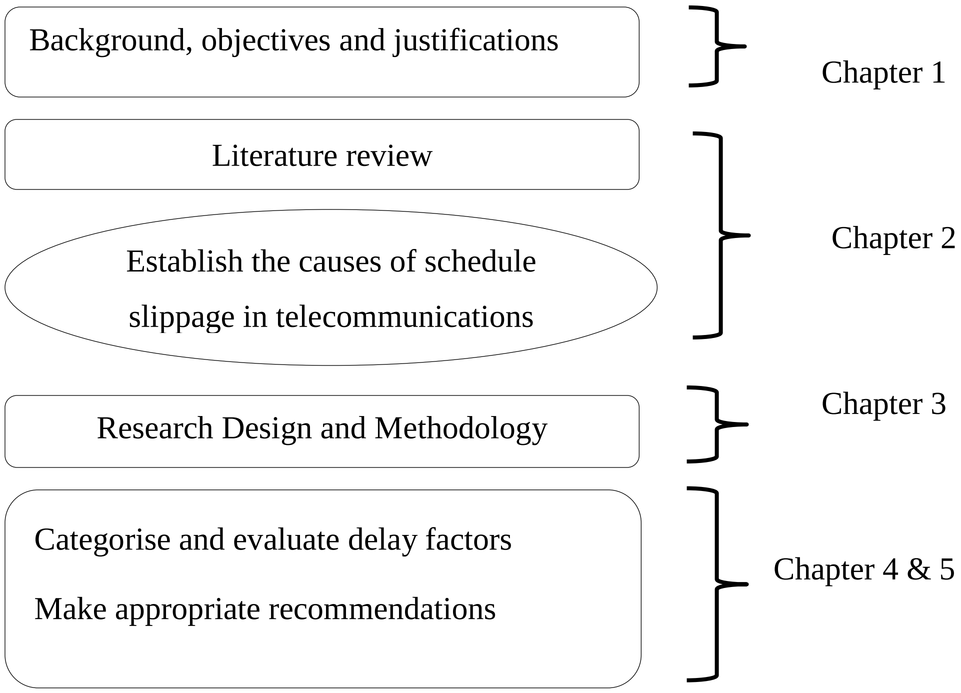


Figure 1.3: Research approach and Chapter overview

Source: Researcher (2015)

1.10 Summary

This chapter has highlighted the problems that exist in delivering projects in the telecommunication industry in Zambia. The chapter gave background information of the industry, giving justification why the research is valuable. The research aim and objectives have been explained, stating the scope and the limitations of the research.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

The previous chapter presented an overview of project schedule overruns in infrastructure projects, highlighting telecommunication network deployment. The rationale and objectives of the study were also presented. This Literature Review chapter examined the main factors causing project time overrun in infrastructure projects in general, then focusing mobile telecommunication projects. The study within this review of literature focused on objectives 1 and 2 as set out in sub-section 1.4 of the Introduction chapter.

Section 2.2 discusses project time management in general, highlighting the processes involved in schedule development and control. Section 2.3 looks at the project schedule overrun, followed by section 2.4, which reviews the causes of the slippages as discussed by previous researchers.

By exploring the above areas of literature, a significant contribution was made to this research. A clear focus, and justification, emerged for empirical research in the time management in telecommunication projects.

2.2 Project Time Management

Time performance is one of the most important indicators of project success. A successful project is one which has accomplished its technical performance, maintained its schedule, and remained within budgetary costs (Olawale & Sun, 2010, pp. 509 – 526). Project time management is one of the critical success factors in project deployment, and is done throughout the lifecycle of the project. It includes the processes required to manage timely the completion of the project, processes for time planning, scheduling and control (Project Management Institute, 2008, p. 160). It comprises planning process, executing process and monitoring and controlling process groups, which yield the project schedule. As Kaewpaitoon & Teeravaraprug (2010) put it, “the function of scheduling is to determine the time needed and to keep the time determined”.

Figure 2.1 shows the interaction of the scheduling methodology, scheduling tools and outputs from the project time management processes to create a project schedule. The scheduling methodology can either be resource-driven or fixed-duration scheduling, while some of the better known scheduling tools include critical path method, critical chain and Gantt charts, in which precedence of activities is determined in order to develop the activity network diagram (Project Management Institute, 2008).

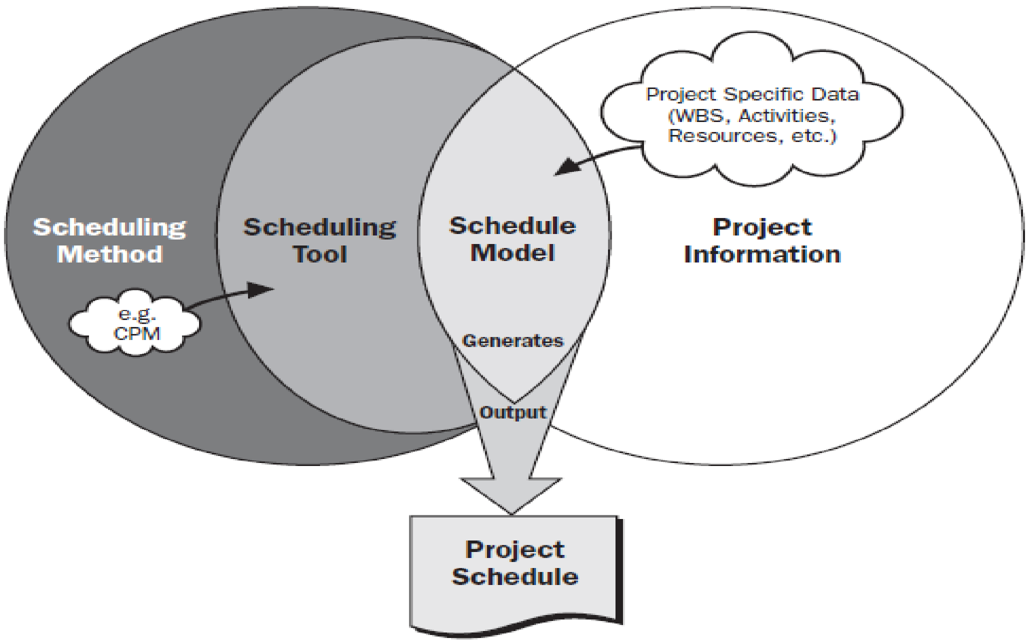


Figure 2.1 : Scheduling Overview

Source: Project Management Institute (2008)

The project schedule is developed through estimation of the activity durations. Desai *et al*. (2014) define estimating as a process of forecasting or approximating the time of completing project deliverables. They state that although the estimation techniques have become better and sophisticated in recent times, estimation is still a characteristically complex exercise. Because time estimates are the lifeline for project time control, serving as the standard for comparison of actual and plan throughout the life of the project to determine variances, reliable estimates are a critical input at project planning stage. Though experience is a good starting point, it must be refined by other considerations, taking into account the uniqueness of the project and its resource requirements. The PMBOK® Project Time Management (PMI, 2008, pp. 160-195) includes six generic time management process groups – five processes resulting in the Develop Schedule process. The schedule development process should generate a project schedule that meets the following criteria:

- **Complete** — the schedule must represent all the work to be done. The quality and completeness of the WBS is so important to achieve completeness;
- **Realistic** — the schedule must be realistic with regard to time expectations and the availability of beneficiaries to participate; and
- **Accepted** — the schedule must have "buy-in" from team members and stakeholders.

The five core processes, with other non-time management processes that have a direct impact on the project schedule, are shown in Figure 2.2.

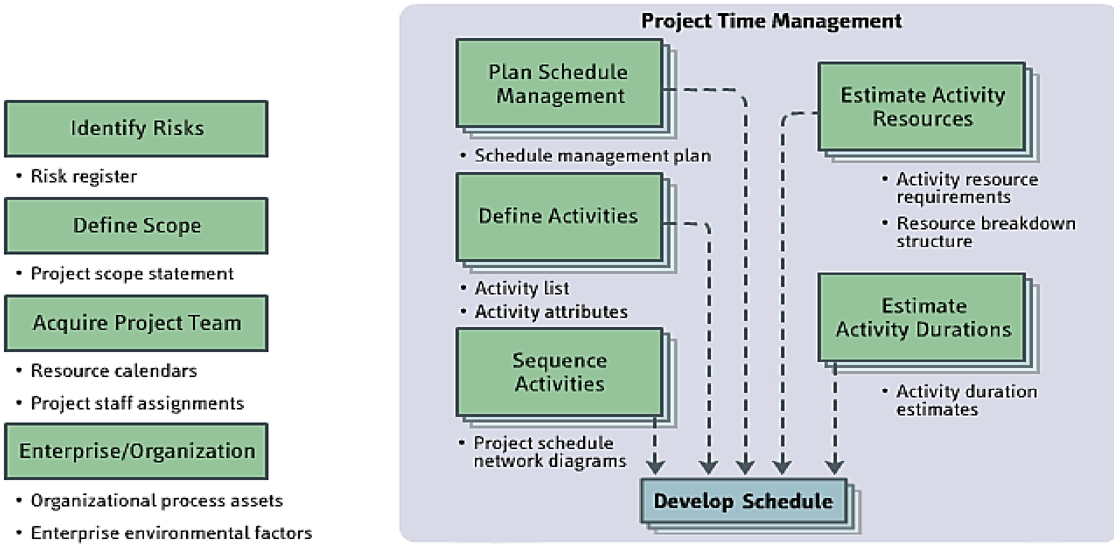


Figure 2.2: Project Schedule Development Processes

Source: PMI (2008)

The Control Schedule process is the seventh time management process which involves four main aspects of schedule management. Figure 2.3 shows the inputs into the control process. Like other controls processes, it ensures that the manager can check the status of the project schedule at all times, influencing factors that could cause schedule changes, using a monitoring system to detect changes that may threaten the schedule, and managing changes as they occur using the project's change control system (Schwalbe, 2014, p. 252). Control schedule tools can be divided into three broad categories:

- Monitoring performance tools – to measure and analyse schedule performance using schedule variance, schedule performance index and trend analysis to determine cause and decide whether preventive or corrective action is required;
- Controlling variance tools – include resource optimization techniques, leads and lags, modelling techniques and schedule compression; and
- Organizational tools – scheduling tools and project management software.

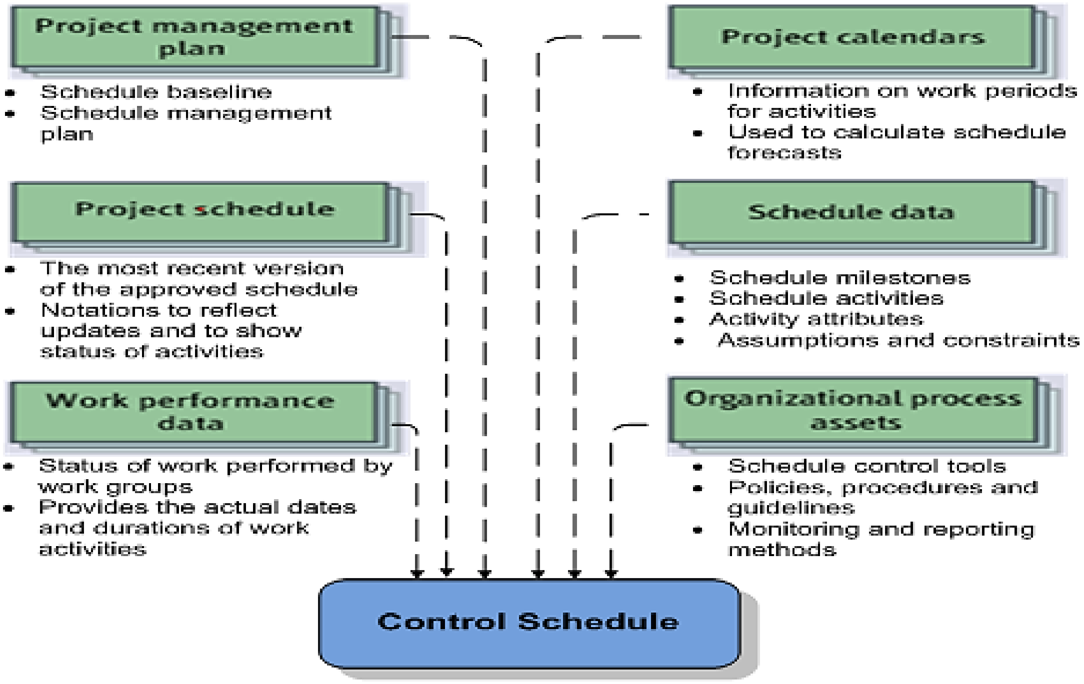


Figure 2.3: Control Schedule Process

Source: Adapted from PMI (2008)

2.3 Project Schedule Overrun

Schedule overrun or slippage refers to situations where the actual project duration exceeds the originally planned and agreed completion period i.e. completion of the project beyond the risk adjusted date. Azis *et al.* (2012) defined time overrun as late completion of works as compared to the planned schedule or contract schedule. It is a project slipping over its planned schedule. Each project plan will have a planned completion date, and an upper limit in the schedule. According to Acharya & Soni, (2007), it is common practice to have three dates associated with any project plan:

- **Non-Risk Adjusted (NRA) Date**: Project completion date assuming no hurdles - this assumes ideal conditions.
- **Risk Adjusted (RA) Date:** Project completion date assuming some risks will come on the way and extra time will be needed to attend to them. This is the realistic target and the project should not exceed this date.
- **Bounding Box (BB) or Upper Limit:** The upper limit on the project plan before which the project has to be finished under any circumstances.

The relation between these dates on a time scale can be explained by Figure 2.4.

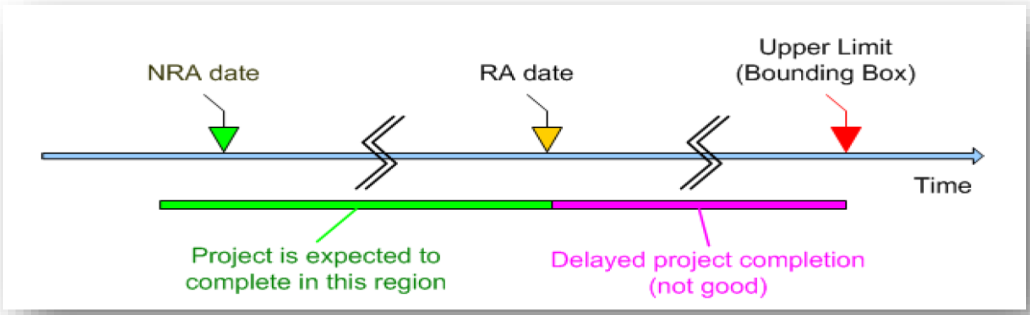


Figure 2.4: Relationship of various dates for project completion on time scale

Source: Acharya & Soni (2007)

Time overrun highlights the non-completion of project within the specified duration as agreed upon in the contract. It occurs when the progress of a contract falls behind its scheduled program. Time overrun is currently a common problem in most of infrastructure projects which causes considerable losses to project parties (Memon, 2014, pp. 1184–1192). Delay is inherent to the project process and a lot of effort should be devoted in identifying and mitigating delay causes and effects. Because of the overriding importance of time for both the Owner (in terms of performance) and the Contractor (in terms of money), it is the source of frequent disputes and claims leading to lawsuits (Marzouk & El-Rasas, 2014, pp. 49-55). Due to their tight linkage, delays have a negative impact on the cost of the project, affecting at least one of the key stakeholders – client, consultant or contractor. Delay types can be classified into four broad categories according to liability - inexcusable, excusable with or without compensation and concurrent delays (Patil & Salunkhe, 2014), shown in Figure 2.5.

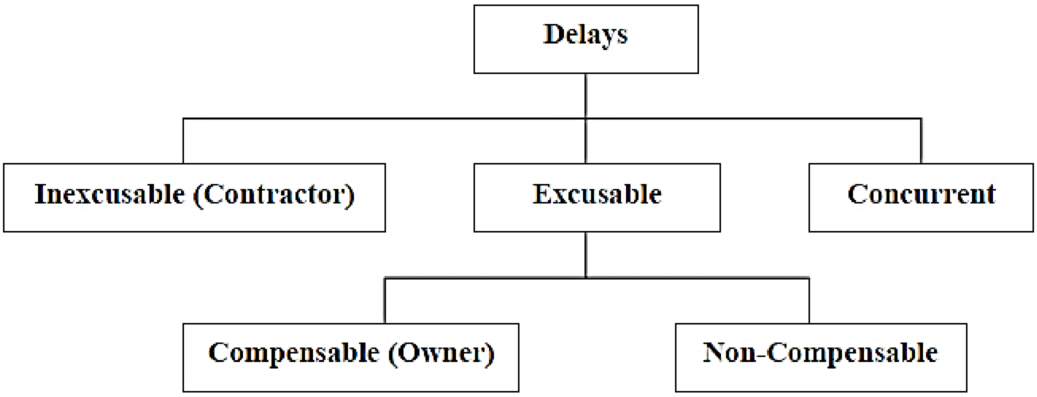


Figure 2.5: Types of Delays

Source: Salunkhe & Patil (2014)

Salunkhe & Patil (2014) describe the different types of delays as below.

- **Non-excusable Delays**

Non-excusable delays are ones which the consultant either causes or assumes the risk for. These are delays which the consultant has complete control of. Examples include underestimates of productivity, inadequate scheduling or mismanagement, construction mistakes, equipment breakdowns, staffing problems, or mere bad luck. Such delays are inherently the consultant's responsibility for which they are generally not entitled to relief and must either make up the lost time through acceleration or compensate the owner.

- **Non-compensable Excusable Delays**

These are delays caused by factors that are not foreseeable, beyond either party's reasonable control and not attributable to the any of the party's fault or negligence. Neither party is at fault under the terms of the contract and has agreed to share the risk and consequences when excusable events occur. The consultant receives no compensation for the cost of delay, but is entitled to time compensation.

- **Compensable Excusable Delays**

These are delays which can be directly attributed to the client's actions, and are thus excusable on the consultant's part, and the consultant may be entitled to equitable adjustments. Examples of these delays include suspensions, or interruptions to all or part of the work caused by an act or failure to act by the client to fulfil their obligation of the contract. The consultant receives both time and money compensation.

- **Concurrent Delays**

If only one factor is delaying construction, it is usually fairly easy to calculate both the time and cost resulting from that single issue. A more complicated but also more typical situation is one in which more than one factor delays the project at the same time or in overlapping periods of time. Concurrent delays occur when both client and the consultant are responsible for the delay. Generally, if the delays are inextricably intertwined, neither the consultant can be held responsible for the delay (forced to accelerate, or be liable for liquidated damages) nor can he recover the delay damages from the owner.

2.4 Factors Causing Schedule Overruns – Previous Researchers

Various researchers have analysed the causes of schedule delays and have classified them accordingly. To be able to address the delay problems, it is important to classify them correctly to ensure the right methods and processes are used to rectify them. As concluded by Gündüz *et al.* (2013) in their research to quantify factors causing project delays, time overrun can only be avoided or minimized when factors responsible for the delays are clearly identified. From the studies carried out by previous researchers, two general schools of thought exist and previous researchers have concentrated on one or the other method to identify the causes of project delays. In this study, the researcher identifies them as conventional and root causes of project delays. Though they are similar in nature, the depth of analysis differs as the root cause analysis tries to find the underlying (real) reason behind the occurrence of the factor.

2.4.1 Conventional Causes

These studies have concentrated on the conventional causes of project delays where responsibility for the delay is emphasized. The immediate factor that leads to the delay has been identified as the cause of the delay, with close linkage to the one responsible for it i.e. client, consultant or contractor. A variety of reasons have been advanced to explain the causes of schedule slippage. The most prominent causes are financial related, change control and decision making or management related.

Financial difficulties rank among the leading causes of construction project delays (Remon, 2013; Akinsiku & Akinsulire, 2012; Marzouk & El-Rasas, 2014; Memon, 2014; Danso & Antwi, 2012; Acai *et al.*, 2014; and Kaliba *et al.*, 2009). Remon (2013), in his study to rank delay factors in construction projects after the Egyptian revolution, cites delay in progress payments as the leading cause of the delays. Akinsiku & Akinsulire (2012), in their research in Nigeria, concluded that in addition to cash flow difficulties experienced by contractors and public agencies, failure by clients to pay for completed works contributes to the delays in proceeding with the remainder of the project.

Frequent specification/scope changes have been highlighted to equally affect the project schedules (Akinsiku & Akinsulire, 2012; Marzouk & El-Rasas, 2014; Memon, 2014; Danso & Antwi, 2012; Acai *et al.*, 2014; and Kaliba *et al.*, 2009). Design errors and scope modifications or changes during execution have equally had adverse impact on schedule performance.

Other delay factors include slow decision making when changes are required. Marzouk & El-Rasas (2014) cite late revision and approval of design documents by owner, while Acai *et al.*, (2014) point to the delay in assessing changes in the scope of work by the consultant as contributing factors to delay. Other delay factors include a lack of skilled manpower across all phases on the project (Acai *et al.*, 2014; and KPMG India; PMI India; 2013). The study carried out by KPMG India in conjunction with PMI India (2012) concluded that majority of projects are delayed by factors which can be controlled at the project level through proper planning and project management.

Table 2.1 summarises the studies carried out by other researchers, highlighting their objectives and findings on factors leading to schedule overruns.

Table 2.1: Content Analysis of Literature Reviewed – Project delay factors

Researcher	Country	Objectives	Major Causes of Delay
Remon (2013)	Egypt	To rank delay factors in construction projects after Egyptian revolution	• Delay in progress payments (Funding problems) • Shortage of equipment • Ineffective project planning and scheduling • Poor site management and supervision
Akinsiku & Akinsulire (2012)	Nigeria	To assess stakeholders' perception of the causes and effects of construction delays on project delivery	• Financial / Cash flow difficulties • Financial difficulties faced by contractors and public agencies • Frequent change order/ design • Failure to pay for completed works • Shortages of resources
Marzouk & El-Rasas (2014)	Egypt	To analyse delay causes in Egyptian construction projects	• Type of project bidding and award (negotiation, lowest bidder) • Ineffective planning and scheduling of project • Variation orders/changes of scope by owner during construction • Late in revising and approving design documents by owner • Finance and payments of completed work by owner

Table 2.1 *Continued*

Kaliba *et al.* (2009)	Zambia	Establish and analyse the factors that lead to cost escalation, schedule overruns and quality shortfalls in construction projects	• Financial difficulties on the part of the contractor • Change order/scope changes • Delayed or non-payment of Interim Payment Certificate • Changes in drawings and specifications • Bad weather (Floods and heavy rains)
KPMG (2013)	India	To analyse the reasons for schedule and cost overruns across various infrastructural projects running across the country	• Delays in land acquisition and site handover • Lack of skilled personnel across all phases • Regulatory approvals • Design / scope changes
Bibi *et al.* (2011)	Pakistan	To study the causes of delay and effects of delay	• Slow and late payments by the clients • Inaccurate time estimation • Poor quality of materials • Poor site management
Jacob & Sunjka (2013)	Nigeria	Investigation of the major causes and effects of construction project delays in the Niger Delta Region	• Inadequate planning by the contractors • Delay or non-payment of compensation to the communities • Wrong choice of consultants and contractors by the clients • Weather conditions

Table 2.1 *Continued*

Krishnamoorthy *et al.* (2014)	India	To identify contract clauses that affect the schedule performance and project profitability of the construction projects	• Shortage of unskilled and skilled labor • Design changes by owner or his agent during construction • Fluctuation of prices • High waiting time for availability of work teams • Rework due to errors
Gündüz *et al.* (2013)	Turkey	Identify categorize delay factors in construction projects; and quantify the relative importance of delay factors	• Inadequate contractor experience • Ineffective project planning and scheduling • Poor site management and supervision • Design changes by owner or agent during construction • Late delivery of materials
Adimabua J. Odita (2012)	Nigeria	Investigating Project Performance in the Telecommunications Sector	• Lack of Planning • Competing Resources • Changing Requirements & Specifications • Unclear Objectives • Unrealistic Time Frames

Table 2.1 *Continued*

Memon (2014)	Malaysia	To study contractor perspective on factors causing time overrun in Malaysian construction projects	• Frequent design changes • Change in the scope of the project • Financial difficulties of owner • Delays in decision making • Unforeseen ground condition
Danso & Antwi (2012)	Ghana	Evaluation of the Factors Influencing Time and Cost Overruns in Telecom Tower Construction in Ghana	• Client's delay of payment • Unrealistic clients' requirements • Lack of tower materials in the local markets • Delays in design work • Design information and contract modifications
Acai *et al.* (2014)	Uganda	An assessment of the factors causing delays on building construction projects in Uganda	• Delay in assessing changes in the scope of work by the consultant • Financial indiscipline/dishonesty by the contractor • Inadequate contractor's experience • Design errors made by designers • Inadequate site investigation by the consultant

Source: Researcher (2016)

2.4.2 Root Causes Analysis

While there is a general agreement on the causes of project schedule slippage, there is a school of thought that a distinction between "causes" and "root causes" should be made in order to effectively address the non-conformance problem. Until the root cause of the problem is identified and resolved, the effects cannot be eliminated (Flyvbjerg, 2011, p. 323). The National Centre for Patient Safety (2011) defines root cause analysis (RCA) as a process for identifying the basic or contributing causal factors that underlie variations in performance associated with adverse events. RCA is a structured team process that assists in identifying underlying factors or causes of an adverse event, which aims at improving products or processes and it is undertaken in systematic way in order to be effective. It helps in understanding the contributing factors or causes of a system failure and can help develop actions that sustain the correction. The general process for undertaking a root cause analysis are:

i. Identify and describe the adverse event or problem to be investigated and gather preliminary information;
ii. Collect and organize the facts surrounding the event to understand what happened;
iii. Identify potential causes or contributing factors;
iv. Identify the root causes – Carry out a thorough analysis of contributing factors to identify the underlying process and system issues (root causes) of the event;
v. Identify solutions that will be effective in preventing repeat problems
vi. Design and implement changes to eliminate the root causes; and
vii. Monitor changes to ensure that they have effectively eliminated the problem.

Aminah & Chai (2013), in their investigation of causes of construction delays in Malaysia, reclassified them as structural, institutional and cultural. They argue that although most of the causes of delays have been identified for decades, they still occur because of the way they are categorised, and thus treated. They state "through the classification of structural, institutional and cultural delay, the construction delay can be treated systematically through organization system, government institutional procedures and construction players' cultural behaviour".

- **Structural Delay**

Structural delays are due to the composition of the project team, their daily duties and responsibilities. The project team could be appended, stand-alone or partnership structure. Each of these has its own merits and demerits where time management is concerned.

- **Institutional Delay**

These delays are as result of statutory or regulatory requirements. Some projects may require clearance from authorities before proceeding. Anil *et al.* (2012) concluded, in their study to analyse factors affecting delays in Indian construction projects, that local authority related and technical issues are the most important problem in India construction projects as many have overlooked the duration taken for the development approval.

- **Cultural Delay**

Cultural delays are ones due to the organizational culture; behaviour, practices, attitudes of the decision maker, interrelated to the organization structure in making decision (Aminah & Chai, 2013, pp. 107-117). This is more important in international organizations or projects. The challenges could range from time differences, language barriers to cultural beliefs and concept of social organization. Building a trustworthy and sound working relationship between the project teams and stakeholders is critical to the success of the project.

In his study of major projects, Flyvbjerg (2011, pp. 321-344) argues that the stated causes are symptoms and not the real or root causes of project delays. He argues that "the root cause of underperformance is the fact that project planners tend to systematically underestimate or even ignore risks of complexity, scope changes, etc. during project development and decision-making". His conclusion was that at the most basic level, the underlying causes of project underperformance may be grouped into three categories, each of which will be considered in turn: (1) bad luck or error; (2) optimism bias (psychological); and (3) strategic misrepresentation (political).

- **Bad luck or error**

Delays due to bad luck or error are those by factors that that could not be foreseen and predicted and are thus beyond either party's reasonable control and not attributable to the any of the party's fault or negligence. Though this is the typical explanation given by management for schedule failure, he argues that with experience their occurrences can be kept to a minimum through improved risk forecasts and predictions.

- **Optimism bias**

Optimism bias is responsible for failures attributed to consequence of flawed decision-making. This is caused by managers making decisions based on delusional optimism rather than on a rational weighting of gains, losses, and probabilities – they tend to overestimate benefits and underestimate costs and time. Experience of the planners is critical as the initial schedule plan acts as an anchor for later stage estimates. If the initial plan is biased, the effect is worse in later project stages.

- **Strategic misrepresentation**

Strategic misrepresentation accounts for flawed planning and decision-making in terms of political pressures and agency issues, or the presence of what economists refer to as principal-agent problems. According to this model, actors purposely spin scenarios of success and gloss over the potential for failure. Underperformance in terms of strategic misrepresentation account well for the systematic underestimation of costs and overestimation of benefits, sometimes in order to increase the likelihood that their projects, and not their competition's, gain approval and funding.

The third model of root cause analysis studied used the Fishbone Diagram, also known as Ishikawa Diagram. The diagram is a visualization root cause analysis tool for categorizing the potential causes of a problem in order to identify its root causes. It is "an objective, thorough and disciplined methodology employed to determine the most probable underlying causes of problems, complaints and undesired events within an organization, with the aim of formulating and agreeing corrective actions to at least mitigate, if not eliminate, those causes and so produce significant long term performance improvement" (Vorley, 2008, p. 3) The aim of the diagram is to find out the major or most important cause behind a certain problem by examining primary, secondary and/or tertiary causes. It uses the idea that various causes of a problem can be categorised into generic causes and sub-causes through the cause-effect method. A variety of Fishbone diagram presentations, and their generic categories, can be drawn depending on the problem at hand but the below are commonly used generic categories in the service industry.

- **Process** – how work is performed, policies, procedures, rules or work instructions. Process looks at the how time management is carried out.
- **People –** Role of people involved and their impact on the project deployment cycle. This looks at the interaction of the people with the project, and how this relationship affects the project schedule.
- **Management –** The co-ordination, organizing and controlling functions during the project life cycle and how they affect the schedule.
- **Equipment** – Consideration of all equipment, raw materials and final products that could have a role in non-conformity to project timelines. It encapsulates all processes and actions responsible for the making available the required materials and resources – the procurement and availability of materials to the project.
- **Environment –** Enterprise environmental factors refer to both internal and external environmental factors that surround or influence a project success. These factors may enhance or constrain project management options and may have a positive or negative influence on the schedule.

2.5 Gap Analysis

Several observations can be made from existing literature regarding factors causing project schedule overrun. Most of the researches carried out have their organisational or geographical contexts in developed climes. There are much fewer cases where researches have been conducted in less developed climes, particularly sub-Saharan Africa. It was also established that most studies carried out has tended to focus on mainstream construction industry, with little documentation on time overrun in ICT projects in general. Of the ICT studies, most of them researches and surveys in recent times have focused on IT/IS projects with emphasis on software projects. The above gaps informed the focus of this research on a telecommunications industry, to gain an insight into the causes of schedule overrun in Zambia. The researcher sought to investigate factors that influence the project schedule performance in the telecommunication sector, by adopting a root cause method of analysis.

2.6 Summary

This chapter presented a review of the literature on the subject schedule slippage or time overruns. The literature analysis and review highlighted the different causes and remedial theories of schedule slippages presented by various researchers based on the findings. It has been established that there is close linkage between categorization of factors and remedial actions prescribed. This research adopted the root cause analysis approach using the Fishbone diagram method to analyse and evaluate the causes of project delays in telecommunication sector in Zambia.

CHAPTER 3 : METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to carry out the research presented in this research in order to address the defined study aim and objectives. The chapter further explains how the problem was investigated and describes the tools used to undertake the investigation, giving justification for the choice of the methods and tools used. It also describes the characteristics of the research sample and the methods of data analysis employed.

This research study has a number of inter-related objectives set within the context of telecommunication projects time management. A valuable aspect to this research work relates to Objective 3: to evaluate the delay factors according to their importance level on delays as viewed by the project stakeholders, from which recommendations are derived. In Chapter 2, it has been shown that there exists a large body of theoretical and empirical literature on project time overrun with literature suggesting that delays are generic to infrastructure projects and are a global phenomenon. It has also been established that there in less literature on delays in telecommunication projects, particularly in Zambia. Objective 1 was addressed through literature review and focus group discussions. The focus group discussion, to establish delay factors, was necessitated by the lack of information particular to the telecommunication industry in Zambia. Objective 2 was answered by identifying the stages in which the established delay factors fall. Objective 3 was addressed by questionnaire survey, and carrying out data analysis using triangulation method.

3.2 Research Design

Research design refers to the overall strategy that the researcher chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring the research problem is effectively addressed. Essentially, the research design creates the foundation of the entire research work (Chinnathambi, Philominathan, & Rajasekar, 2013, p. 22). The research was divided into four study phases. The first part involved definition of the problem, putting into context the degree to which project experience schedule slippages. The aims and objectives were then laid, stating the scope and limitations of the study. The second part involved carrying out an extensive literature review of similar studies done. The review of previous studies further highlighted the gaps that exist as far as the telecommunication projects in Zambia is concerned. It also helped develop a framework on which the rest of the research hinged. Data collection formed the third part of the research. Because the study involved both qualitative and quantitative methods, data was using interviews and questionnaire surveys. The collected data was then analysed using appropriate data analysis tools to rank the relative importance of the identified project delay factors. Conclusions and recommendations were derived from the results. Figure 3.1 shows the adopted research design.

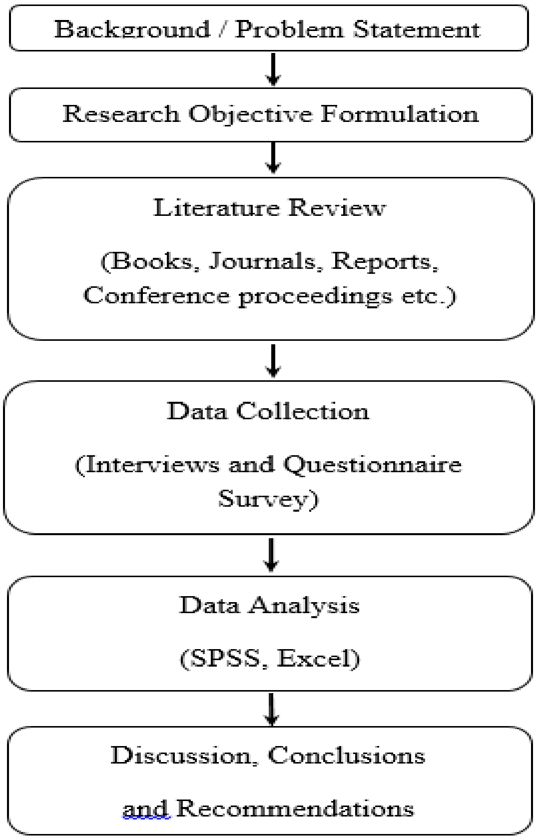


Figure 3.1: Research Design

Source: Researcher (2015)

3.3 Research Strategy

Various research strategies have been identified in literature that can be employed to answer the research objectives. The choice of the strategy depends upon among others, the research question, objective, the amount of time and existing knowledge (Muhammad & Pattharawan, 2010, p. 35). A research strategy refers to the overall strategy that the researcher chooses to integrate the different components of the study in a consistent and logical way. Among the many research strategies commonly used for related studies are Case study and Surveys. Biggam (2008) defines a case study as study of one example of a particular type. Basically, it is an in-depth study of a particular situation used to narrow down a very broad field rather than a sweeping statistical survey. A case study would not meet the requirements of this study as a broad understanding of the delay factors affecting the whole sector are being investigated. It would have been the best strategy if a particular network operator was chosen for investigation. As the generalized features of delay factors affecting the sector as a whole are being investigated, this researcher adopted a survey research using both descriptive quantitative and qualitative methods in tandem. Biggam (2008) defines a survey is a representative selection from the population of a particular type i.e.it is used when seeking representative views. He further decribes a descriptive qualitative research as an in-depth exploratory study that gives detailed descriptions of specific situations in their natural environment using interviews, observations and document reviews, while descriptive quantitative uses numerical descriptions by collecting numerical data that are analysed using mathematically based methods. Quantitative and qualitative techniques provide a trade-off between breadth and depth and between generalizability and targeting to specific populations, and when carefully used together the two techniques provide the most useful information. Also, because both methods of data collection have limitations, the use of multiple methods can neutralize or cancel out some of the disadvantages of certain methods (Tashakkori & Teddlie, 2003).

3.4 Data Collection

Data was mainly gathered through two broad sources – primary and secondary.

3.4.1 Secondary Data

The secondary research data was collected from studies carried out by other researchers. Various journals, articles, books, reports and lecture notes were used as the main source of secondary data. This data provided the basis for the formulation of the framework for the study. The main objective throughout the review stage was to identify factors likely to be relevant in studying schedule overruns in telecommunication projects. In order to achieve the objectives, a systematic literature review was conducted to place the study in a perspective and identify gaps that exist. Through the literature review, Objective 1.4.2 (i), establish factors contributing to time overruns and (ii), categorise the factors, were addressed. The root cause approach was adopted to address the research questions.

3.4.2 Primary Data

Primary data refers to the data collected personally by researcher during the study. In this study, interviews were used as data collection instrument for qualitative information while questionnaire survey was used for quantitative data. A multi-mode approach was adopted as it provides a trade-off between breadth and depth, and between generalizability and targeting to specific (sometimes very limited) populations and can increase both the validity and the reliability of the data (National Science Foundation, 2010). The main benefit of using triangulation as described by many researchers is the validation of qualitative results by quantitative studies (Hussein, 2009). For completeness purposes Hussein (2009) further states that researchers use triangulation to increase their in-depth understanding of the phenomenon under investigation by combing methods and theories. The interaction of different research methods in triangulation is as depicted in Figure 3.2.

The interviews were required to identify what respondents perceive as the causes of the delays. It was important to get the respondents' practical experience, and integrate the response with the ones obtained from literature review to enhance the quality of the questionnaire survey. The questionnaire survey was used to collect quantitative data, which was used to evaluate and analyse specific delay causes. Through this triangulation method, a better and deeper understanding was obtained.

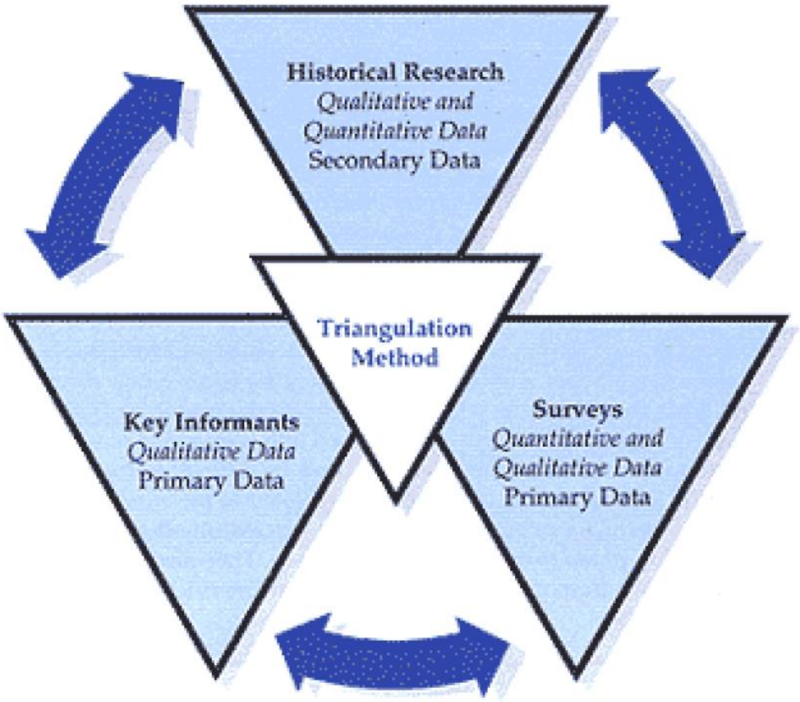


Figure 3.2: Triangulation Method

Source: Hussein (2009)

i) Qualitative Data Collection

Data collection tools for qualitative data include participant observation, focus group discussions and interviews. Each of the tools has its own advantages and disadvantages, as well as their applicability. It is therefore important to use the correct tool to be able to collect the appropriate data for the study. Some of the qualitative data collection tools are discussed below.

a) Interviews

The use of interviews as a data collection method begins with the assumption that the participants' perspectives are meaningful, knowable, and can be made explicit, and that their perspectives affect the success of the project (National Science Foundation, 2010, p. 50). Two types of interviews are used: structured interviews, in which a carefully worded questionnaire is administered, and in-depth interviews, in which the interviewer does not follow a rigid form. In structured interviews, the emphasis is on obtaining answers to carefully phrased questions while in-depth interviews seek to encourage free and open responses. In-depth interviews also encourage capturing respondents' perceptions in their own words, a very desirable strategy in qualitative data collection.

Advantages:

- Usually yield richest data, details, new insights
- Permit face-to-face contact with respondents
- Provide opportunity to explore topics in depth
- Allow interviewer to experience the affective as well as cognitive aspects of responses
- Allow interviewer to explain or help clarify questions, increasing the likelihood of useful responses
- Allow interviewer to be flexible in administering interview to particular individuals or in particular circumstances

Disadvantages:

- Expensive and time-consuming
- Need well-qualified, highly trained interviewers
- Interviewee may distort information through recall error, selective perceptions, desire to please interviewer
- Flexibility can result in inconsistencies across interviews
- Volume of information very large; may be difficult to transcribe and reduce data

b) Observation

Observational techniques are methods by which an individual or individuals gather firsthand data on programs, processes, or behaviors being studied. They provide evaluators with an opportunity to collect data on a wide range of behaviors, to capture a great variety of interactions, and to openly explore the topic. By directly observing operations and activities, the evaluator can develop a holistic perspective i.e. an understanding of the context within which the project operates. Observational approaches also allow the evaluator to learn about issues the participants or staff may be unaware of or that they are unwilling or unable to discuss candidly in an interview or focus group.

Advantages:

- Provide direct information about behavior of individuals and groups
- Permit evaluator to enter into and understand situation/context
- Provide good opportunities for identifying unanticipated outcomes
- Exist in natural, unstructured, and flexible setting

Disadvantages:

- Expensive and time consuming
- Need well-qualified, highly trained observers; may need to be content experts
- May affect behavior of participants
- Selective perception of observer may distort data
- Behavior or set of behaviors observed may be atypical

c) Focus Groups

Focus groups combine elements of both interviewing and participant observation. The hallmark of focus groups is the explicit use of the group interaction to generate data and insights that would be unlikely to emerge otherwise. The technique inherently allows observation of group dynamics, discussion, and firsthand insights into the respondents' behaviors, attitudes, language, etc. Focus groups are a gathering of number of people who share some characteristics relevant to the evaluation. They provide answers to the same types of questions as in-depth interviews, except that they take place in a social context. Specific applications of the focus group method include:

- Identifying and defining problems in project implementation
- Pretesting topics or idea
- Identifying project strengths, weaknesses, and recommendations

- Assisting with interpretation of quantitative findings
- Obtaining perceptions of project outcomes and impacts
- Generating new ideas

In this study, a semi-structured interview was used as the main data collection tool for qualitative data. Interviews, aimed at obtaining preliminary data that would enhance the questionnaire survey, were conducted prior to questionnaire surveys. The sixteen participants were carefully selected to ensure that various viewpoints of the main stakeholders in the telecommunication industry were incorporated in the questionnaire survey. The interviews, therefore, were targeted at professionals working for clients, equipment vendors and contractor organisations within the telecommunication sector in Zambia. The respondents consisted of six from mobile network operators, four from the equipment vendor companies, three from infrastructure support companies, two from contractors and one from the regulatory authority. The interviews were limited to participants within Lusaka, the capital city, because all the major stakeholders in telecommunication projects have their head offices in Lusaka and most of the experienced professionals in projects are based at the headquarters.

ii) Quantitative Data Collection

The questionnaire survey was adopted as the main quantitative data collection tool to follow on information obtained from interviews. The questionnaire was prepared based on the identified possible causes of project delays. It contained the respondent's profile and their evaluation of delay factors' frequency of occurrence and their impact according to their own judgment and experience. The developed questionnaire for the survey was based on 34 factors of time overruns. To ensure no bias by the participants, the categorization of the factors was not included in the questionnaire. It was hoped that without prior knowledge of the grouping, the respondents would give more objective responses. A five-point scale of 1 to 5 was adopted for each factor and respondents were asked to rate. The scale for frequency is categorised as follows 5 = Always; 4 = Frequently; 3 = Sometimes; 2 = Rarely; and 1=Never. For impact the scale was 5 = Very High; 4 = High; 3 = Moderate; 2 = Low; and 1 = No Impact. A combination of an online and self-administered questionnaire methods was adopted. This method was effective as it ensured that the questionnaires reached the targeted respondents quickly and within budget.

3.5 Sampling Method

This research followed both purposive and stratified sampling for the two data collection tools used. Purposive sampling was used during interviews by selecting participants with considerable years of experience and/or based on their organizational position. Project managers and experts from mobile network operators (MNO), the equipment vendors used by these mobile operators (Ericsson, Huawei and Nokia), telecommunication infrastructure companies (I.H.S and ZESCO), as well as the ICT regulator (ZICTA) were interviewed. Stratified sampling was used to obtain the quantitative data from the professionals from the same organizations using the questionnaire. The population sample of this research was composed of three strata: professionals from design, operations and project deployment. Because it was not possible to ascertain the total number of engineers in the telecommunication industry in Zambia, equation 3.1, by Scott (2013), was used to approximate the sample size. At confidence level 90%, margin of error of ±10% and standard deviation of 0.5, sample size of 68 professionals was computed.

$$\boldsymbol{n = \left(\frac{Z\sigma}{E}\right)^2}$$ .... **Equation 3.1:** Sample size

Where: **n** is the sample size

$\boldsymbol{Z}$ is the z-score i.e. 1.645

σ is the standard deviation

$\boldsymbol{E}$ is the margin of error

Source: Scott (2013)

3.6 Analysis of the Chosen Research Techniques

3.6.1 Interviews

It was important to collect the local views of the professionals in the telecommunication industry prior to the questionnaire survey. The interviews were aimed at obtaining primary data that would enhance the questionnaire survey. Of the possible qualitative data collection tools, interviews were selected to collect preliminary views on the project delay causes. Because generalized data was required, either focus group discussion or interviews would have been used to collect the data. However, due to the associated cost and challenges in gathering the respondents from different companies to brainstorm on the causes of project delays focus group discussion was discarded. Interviews were adopted, instead, as the required data could be collected easier and cheaper by talking to each respondent on a one-on-one basis. The interviews were limited to sixteen telecommunication professionals from three network operators, equipment vendors, infrastructure companies, the regulatory authority and contractors. Purposive sampling was used on the participants based on their experience and knowledge of telecommunication projects. Observation was not used to avoid any bias as the researcher is a Telecommunication professional.

3.6.2 Fishbone Diagram

The fishbone diagram is brainstorming in a structured format, which focuses on the causes rather than the effect of problem. It is a better tool for management decision-making as it streamlines the problem factors into identifiable control areas. The approach has also been used by Figgins (2012), Gündüz, Nielsen, & Özdemir (2013) and Krishnamoorthy, Kumar, & Ravisankar (2014) in their respecitive studies, though with different primary causes. After analysis of the interviews, the basic approach was adopted, where all causes are categorised under process, management, equipment, people or environment. From the literature and interviews, secondary and tertiary causes were identified, which were categorised as shown in Figure 3.3. This formed the basis for questionnaire development, which was subjected to the rest of the telecommunication professionals.

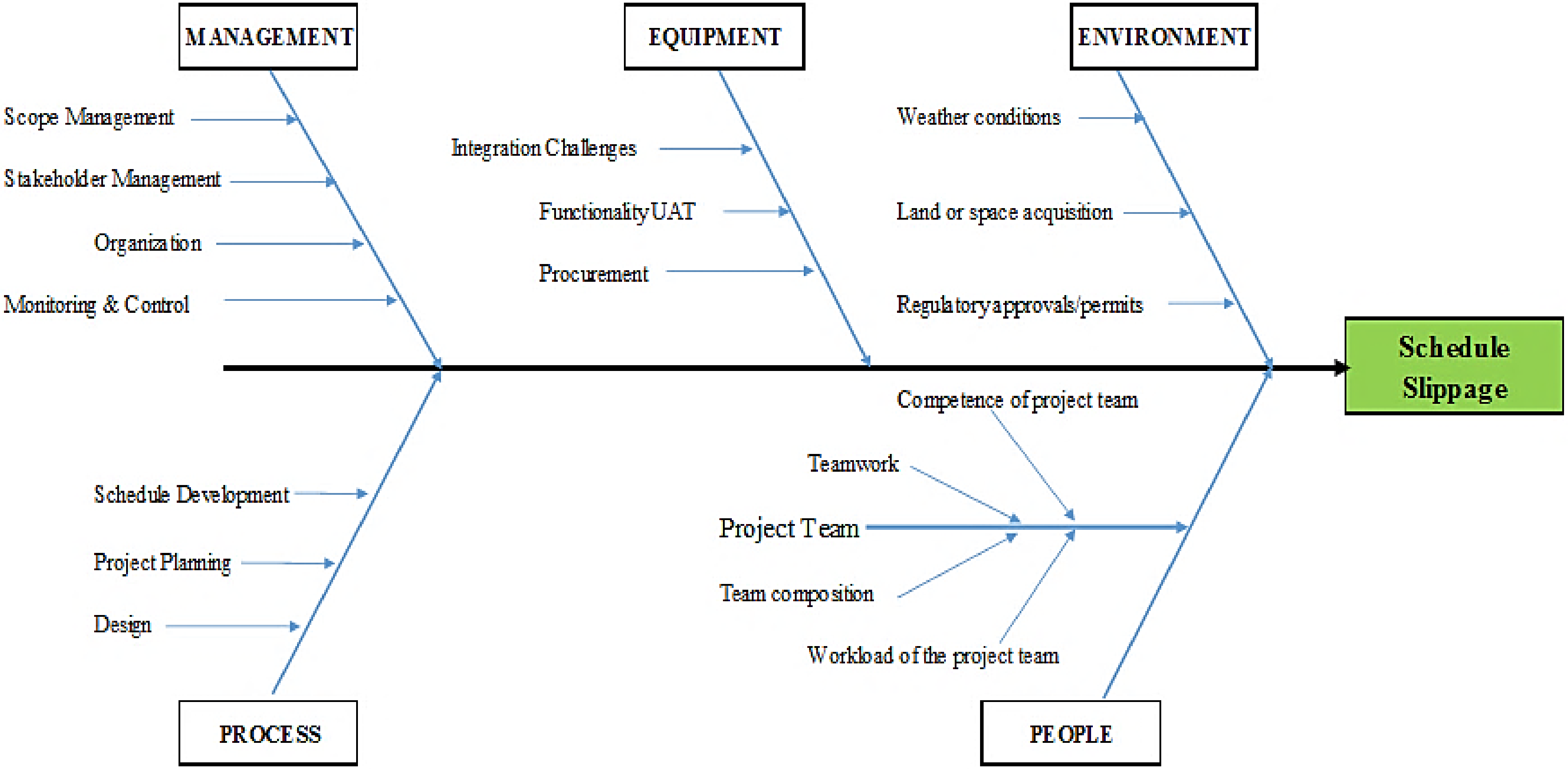


Figure 3.3: The Fishbone Diagram – Identified causes of schedule slippage

Source: Adapted from Figgins (2012)

3.7 Data Processing and Analysis

Qualitative data, collected using semi-structured interviews, was organized and mapped according to the identified cause. Three levels of the problem were defined and the causes mapped accordingly.

i) Variable identified the actual causes of the delays.
ii) Construct identified the underlying reason for the project delays, which could not be measured directly but only through indicators or variables.
iii) Dimension is the high-level generic cause of the delay i.e. the five categories identified in the fishbone diagram.

The mapping of the three levels is as shown in Table 4.1. This formed the basis for the questionnaire survey. Data collected from the survey was analysed using descriptive statistical techniques. Statistical Package for Social Science (SPSS) and MS Excel were chosen as the best options available to arrange and analyse the large body of data in a systematic, fast and reliable way.

To be able to sort and rank the data the quantitative data, it was important to use the appropriate index technique that combines frequency and impact of the causative factors on the project schedule. The factor importance index technique, as used by Megha & Rajiv (2013) was thus adopted. In this technique, for each cause/factor respondents were asked two questions: to rate the frequency of occurrence for the cause and its impact on the schedule, on a Likert scale 1 to 5. The weightings are as shown in Table 3.1.

Table 3.1 : Frequency - Severity Matrix

	Frequency Weighting		**Severity Weighting**	
Scale	**Frequency**	**Weight**	**Severity**	**Weight**
1	Never	1	None	1
2	Rarely	2	Low	2
3	Sometimes	3	Moderate	3
4	Frequently	4	High	4
5	Always	5	Very High	5

Source: Researcher (2016)

Weighted average model was used to determine the Frequency Indices (FI) and Severity Indices (SI) of the causes of cost schedule slippage. Equations 3-2 and 3-3 were used to compute FI and SI, respectively.

$$FI = \frac{\sum_{n=1}^{5} F_h P_h}{\sum_{n=1}^{5} N_h} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{Equation 3-2: } \text{Frequency Index}$$

Where: F_h is the frequency weight assigned to option h (ranges from 1 to 5)

P_h is the number of participants who responded to option h

N_h is the total number of responses

Source: Kaliba, Muya, & Mumba (2009)

$$SI = \frac{\sum_{n=1}^{5} S_k P_k}{\sum_{n=1}^{5} N_k} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{Equation 3-3: } \text{Severity Index}$$

Where: S_k is the severity weight assigned to option k

P_k is the number of participants who responded to option k

N_k is the total number of responses

Source: Kaliba, Muya, & Mumba (2009)

The Factor Importance Index, calculated as a function of the frequency and severity indices, was computed using equation 3-4. Table 3.2 was computed using percentages.

$$FII = FI \otimes SI \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \textbf{Equation 3-4: } \text{Factor Importance Index}$$

Source: Kaliba, Muya, & Mumba (2009)

Table 3.2 : Importance Index

⊗		FREQUENCY				
		0.2	**0.4**	**0.6**	**0.8**	**1**
SEVERITY	**0.2**	0.04	0.08	0.12	0.16	0.2
	0.4	0.08	0.16	0.24	0.32	0.4
	0.6	0.12	0.24	0.36	0.48	0.6
	0.8	0.16	0.32	0.48	0.64	0.8
	1	0.2	0.4	0.6	0.8	1

Source: Researcher (2016)

The ranking of the factors was based on the FII matrix below.

Range	**Category**
0 – 0.25	Low
0.26 – 0.50	Moderate
0.51 – 0.75	High
0.76 – 1.0	Critical

3.8 Ethics and Data Protection

It is important to be mindful of ethical and data protection issues when conducting research. Ethical guidelines seek to work towards protecting the individuals, communities and environments involved in the studies against any form of harm, manipulation or malpractice. When conducting research, one must consider ethics in order that they work within the law, to professional guidelines and act morally. The three principles of ethics include informed consent, confidentiality and avoiding harm and do good (Hay & Israel, 2006, pp. 129-143). These were strictly adhered to by following all due processes that were necessary in the design, data collection, processing, analysis and interpretation phases of the research.

- Informed consent – The research aims, objectives and the use of their responses from respondents were explained to the participants. It was important for the respondents to understand the reasons for the research so as to get their informed consent. The participants were expressly asked to indicate consent before proceeding with the questionnaire and interview.
- Confidentiality – Confidentiality was assured to the participants and their responses were only used for this particular research without disclosure or exposure to third parties. Respondents were requested to remain anonymous and no information that could easily identify the respondent was collected.
- Avoid harm and do good – It is important that the research does not only avoid harm, but to ensure that its purpose is to do good.

3.9 Summary

This chapter provided the theory underpinning the research design and the research methodology to investigate the causes of project delays telecommunications sector in Zambia. Various methodologies that could be adopted for research purposes were discussed, with justification of the multimode approach and the appropriate data collection tools.

The next chapter discusses the data that was collected and analysed in the study.

CHAPTER 4 : RESULTS AND DATA ANALYSIS

4.1 Introduction

Having outlined the methodology that was used for carrying out the research and the techniques used during data collection in the last chapter, this chapter presents results obtained and their analysis. Section 4.2 presents information obtained from the interviews, while section 4.3 presents the results and analysis of the questionnaire survey results.

4.2 Interview data analysis

Semi-structured interviews were used as the data collection tool for the qualitative data. The interviews were conducted between February and March 2017. The interviews were preliminary in nature and targeted sixteen telecommunication professionals working for mobile network operators (MNO), equipment suppliers (Vendors), Contractors and other infrastructure support companies. The interviewees were sampled based on the prominence and role of their organization in telecommunication projects as well as their experience in the industry. The purpose was to obtain an in-depth understanding of how the professionals view telecommunication projects schedule slippages – causes and the possible remedial actions. Appendix II shows the interview questions used to obtain preliminary information.

4.2.1 Profiles of interviewees and their firms

Sixteen out of the targeted eighteen professionals participated in the interviews. The other two professionals could not participate in the interviews due to other commitments in their work places, and the limited time available. All respondents surveyed were based in Lusaka as their companies have head offices in Lusaka, with decision makers and project managers in Lusaka.

Three main attributes sought from the respondents were organization type, role and experience of the respondents. These were viewed to have a major impact of the understanding of projects. Out of the sixteen respondents, six were from the mobile network operators (MNO), four from equipment vendors, three from infrastructure support companies, two from contractors and one from the regulatory authority. In terms of roles, there were six (37.5%) from project deployment, six (37.5%) from operations and four (25%) from design. Figure 4.1 shows the distribution according to organization type.

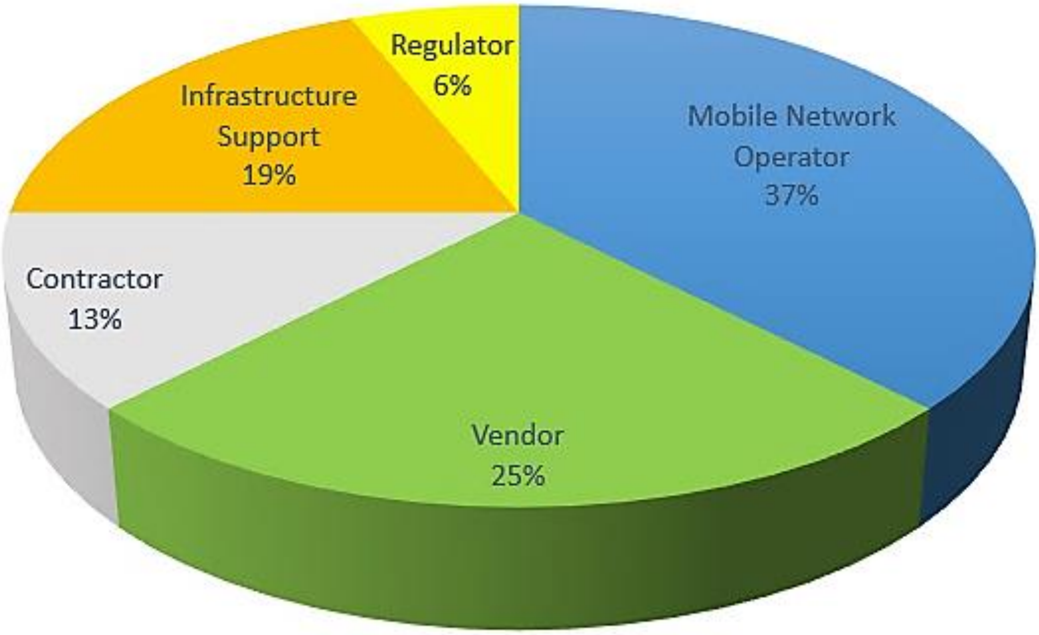


Figure 4.1: Respondent profiles – Organization type

Source: Author (2017)

In terms of experience eighty-one had over eight years of experience in the telecommunication sector and were in middle to top management. Figure 4.2 below shows the distribution of the interviewees in terms of years of experience.

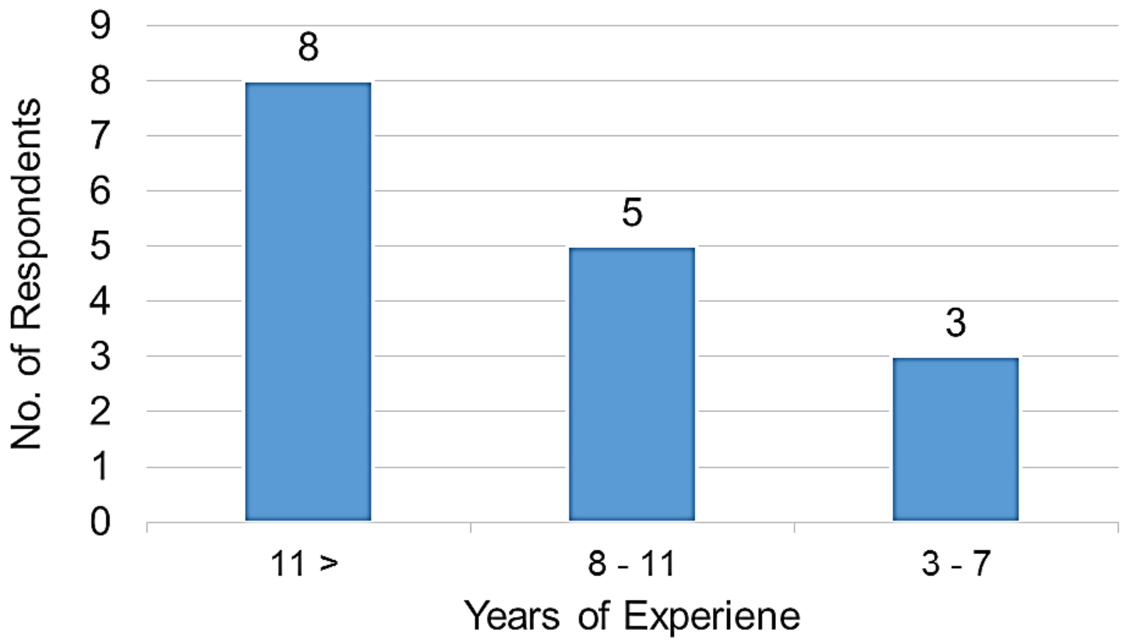


Figure 4.2: Respondent profile – Experience

Source: Author (2017)

4.2.2 Causal factors for schedule slippages

An open-ended question aimed at obtaining the common contributory factors that lead to schedule slippages was posed. Various responses from interviewees were obtained that highlighted the casual factors. The ranking of the factors was based on the number of times the factor was mentioned by the respondent; no weighting was attached. The top four causes of schedule slippages in telecommunication projects identified are:

- Procurement process – Long approval processes, late delivery of equipment by vendors and customs clearing processes
- Poor project planning – Poor resource planning, lack of risk management plan and a lack of end-to-end project integration plan
- Organization – Lack of proper organization chart with clear escalation and responsibility matrices, as well as centralized decision making due to the managed services operational model used by most of these telecommunication companies.
- Stakeholder management – Poor identification and involvement of stakeholder at an early stage of the project, poor communication among project teams and poor

stakeholder expectation management by the project manager, especially from top management.

Figure 4.3 shows the ranking of the causal factors obtained from the interviews conducted

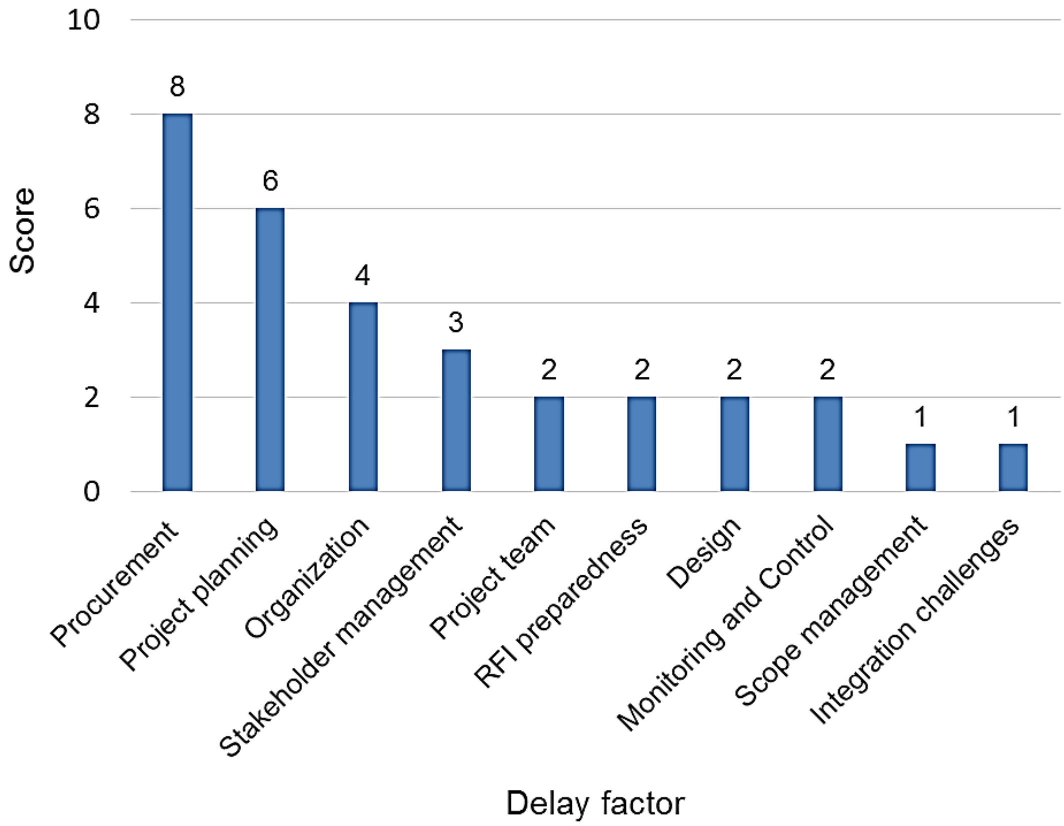


Figure 4.3: Ranking of schedule overrun causal factors - Interviews
Source: Author (2017)

The thirty-four factors identified during literature review and interviews were mapped according to the broad categories from the fishbone diagram. Table 4.1 below shows the factors and the mapping that was done to come up with the fishbone diagram.

Table 4.1: Mapping of identified delay causes in telecommunication projects

DIMENSION (Primary Cause)	**CONSTRUCT (Secondary Cause)**	**VARIABLE (Tertiary Cause)**
Management	Scope Management	a) Unclear project scope and deliverables at initiation
		b) Scope / Specification changes during implementation
	Organization	a) Organizational chart and responsibility matrix
		b) Centralized decision making
	Stakeholder Management	a) Poor stakeholder identification and involvement in project schedule development
		b) Poor communication among team
		c) Stakeholder expectation management
	Monitoring & Control	a) Poor project tracking to check progress
		b) Lack of schedule performance monitoring and controlling tools
		c) Lack of scheduling tools and project management software
Process	Schedule Development	a) Poor activity interdependency identification and sequencing
		b) Under-estimation of activity duration at planning stage
		c) Over optimistic estimates e.g. pressure from management to get things done quickly
	Design	a) Lack of project surveys or feasibility studies e.g. poor information available at planning stage
		b) Lack of or incomplete design document
	Project Planning	a) Poor resource planning
		b) Poor risk management plan (Failure to identify likely risk in the project plan)
		c) Lack of e2e integration plan
People	Project Team	a) Competence of project team
		b) Lack of dedicated project team i.e. staff combine operations and project roles
		c) Cultural and language challenges among project members
		d) Challenges of information sharing among different vendors
		b) Support infrastructure availability e.g. power

Table 4.1 *Continued*

Equipment	Integration Challenges	a) Multi-vendor equipment compatibility challenges
		b) Access to network/site during integration
		c) Rigid processes and procedures e.g. changes allowed only during specific time of day
	Procurement	a) Procurement approval process
		b) Late delivery of project materials by suppliers
		c) Customs clearing processes
	Functionality UAT	a) Acceptance failure - project failure to meet requirements
		b) Delay in acceptances testing and sign off
Environment	Weather conditions	a) Adverse weather conditions
	Regulatory approvals / permits	a) Statutory approvals and permits
	Ready for Installation (RFI)	a) Space acquisition and preparation
		b) Support infrastructure availability e.g. power

Source: Researcher (2017)

4.3 Questionnaire survey data and analysis

The questionnaire survey was carried out over a period of two months, March and April 2017. The questionnaires were sent to telecommunication professionals from mobile network operators, equipment vendors, contractors and infrastructure support companies. Fifty-three out of the targeted sixty-eight responses were received, representing seventy-eight percentage of target.

Thirty-four possible casual factors for schedule overruns obtained from literature and interviews were assessed through the questionnaire survey in terms their frequency, severity and significance on telecommunication projects. The primary or root causes of delays was identified by analysing the factors at secondary and tertiary levels, using the fishbone diagram approach.

4.3.1 Respondent profiles

The profiles of the respondents are as shown in the below. Table 4.2 shows how long respondents have been involved in projects. As can be seen from the table, about eighty percent (80%) of the respondents have experience of at least eight years in telecommunication projects.

Table 4.2: Experience of respondents

Years of Experience	Frequency	Percent	Valid Percent	Cumulative Percent
< 3	2	3.8	3.8	3.8
3 -7	8	15.1	15.1	18.9
8 - 11	28	52.8	52.8	71.7
> 11	15	28.3	28.3	100.0
Total	53	100.0	100.0	

Source: Researcher's data analysis - SPSS excerpt (2017)

In terms of organization, the distribution is as shown in Table 4.3.

Table 4.3: Organization of respondents

Organization	Frequency	Percent	Valid Percent	Cumulative Percent
Mobile Network Operator	13	24.5	24.5	24.5
Vendor	26	49.1	49.1	73.6
Contractor	6	11.3	11.3	84.9
Others	8	15.1	15.1	100.0
Total	53	100.0	100.0	

Source: Researcher's data analysis - SPSS excerpt (2017)

Generic roles and not organizational positions for the respondents were considered and the distribution is as shown in Table 4.4.

Table 4.4: Roles of respondent

Organization	Frequency	Percent	Valid Percent	Cumulative Percent
Project Deployment	15	28.3	28.3	28.3
Design (Planning/Optimization)	11	20.8	20.8	49.1
Operations	26	49.1	49.1	98.1
Others	1	1.9	1.9	100.0
Total	53	100.0	100.0	

Source: Researcher's data analysis - SPSS excerpt (2017)

4.3.2 Ranking of delay factors

The average frequency and severity scores for the thirty-four causal factors were used to compute the factor importance indices, using equation 3-4 above, and ranking based on the computed factor importance indices (FII). The results in Table 4.5 show that there are eight highest ranked factors, with relative importance of 64%.

- Unclear project scope and deliverables at initiation;
- Poor stakeholder identification and involvement, with project managers using a top-down approach in schedule development. Any inadequacies in the schedule are only identified when the project in already running;
- Under-estimation of activity duration at planning stage by project managers;
- Over optimistic estimates by top management pushing that projects are done as quickly as possible;
- Lack of project surveys or feasibility studies, resulting in poor information available at project planning stage;
- Lack of dedicated project team. Most of the companies run a hybrid organizational structure with operations teams used during project implementation;
- Long procurement approval process; and
- Late delivery of project materials by suppliers.

Table 4.5: Ranking of delay factors

#	**Delay Factor**	**FI Score**	**SI Score**	**FII Score**
1	Unclear project scope and deliverables at initiation	4	4	0.64
2	Poor stakeholder identification and involvement	4	4	0.64
3	Under-estimation of activity duration at planning stage	4	4	0.64
4	Over optimistic estimates	4	4	0.64
5	Lack of project surveys or feasibility studies	4	4	0.64
6	Lack of dedicated project team	4	4	0.64
7	Procurement approval process	4	4	0.64
8	Late delivery of project materials by suppliers	4	4	0.64
9	Scope / Specification changes during implementation	3	4	0.48
10	Poor project tracking to check progress	3	4	0.48
11	Poor risk management plan	3	4	0.48
12	Poor activity interdependency identification and sequencing	4	3	0.48
13	Lack of or incomplete design document	4	3	0.48
14	Organizational chart and responsibility matrix	3	3	0.36
15	Centralized decision making	3	3	0.36
16	Poor communication among project team members	3	3	0.36
17	Stakeholder expectation management	3	3	0.36
18	Lack of schedule performance monitoring & controlling tools	3	3	0.36
19	Lack of scheduling tools and project management software	3	3	0.36
20	Poor resource planning	3	3	0.36
21	Lack of E2E integration plan	3	3	0.36
22	Competence of project team	3	3	0.36
23	Cultural and language challenges among project members	3	3	0.36
24	Challenges of information sharing among different vendors	3	3	0.36
25	Multi-vendor equipment compatibility challenges	3	3	0.36
26	Access to network/site during integration	3	3	0.36
27	Rigid processes and procedures	3	3	0.36
28	Customs clearing processes	3	3	0.36
29	Acceptance failure - project snags	3	3	0.36
30	Delay in acceptances testing and sign off	3	3	0.36
31	Space acquisition and preparation - RFI	3	3	0.36
32	Support infrastructure availability	3	3	0.36
33	Adverse weather conditions	2	3	0.24
34	Statutory approvals and permits	2	3	0.24

Source: Researcher’s Questionnaire Survey Results (2017)

Secondary or contributory factors were scored and ranked based on the relationship in Table 4.1. The highest ranked factor is the schedule development process, followed by scope management, design and procurement, as shown in Figure 4.4.

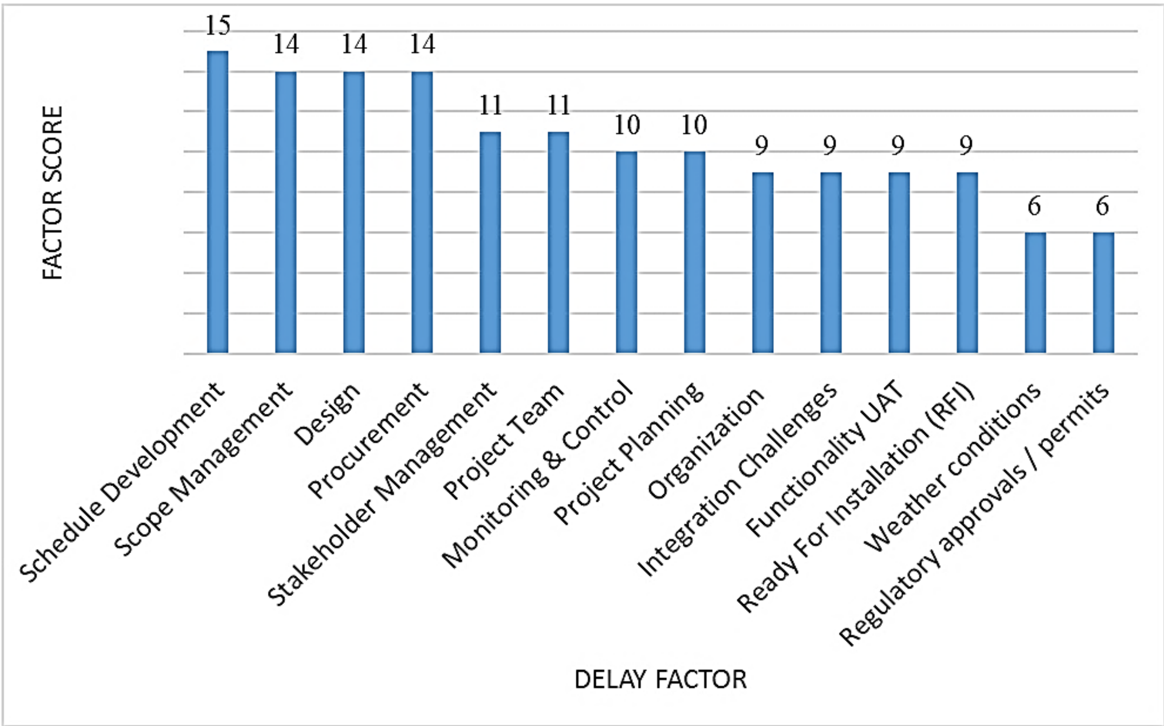


Figure 4.4: Ranking of delay factors (Secondary)
Source: Author (2017)

The primary causes were also scored and ranked, with results showing that "Process" was highest ranked, followed by "Management", "People" and "Equipment". "Environment" was ranked lowest. Figure 4.5 shows the ranking of the primary (root) causes of delays in telecom projects in Zambia.

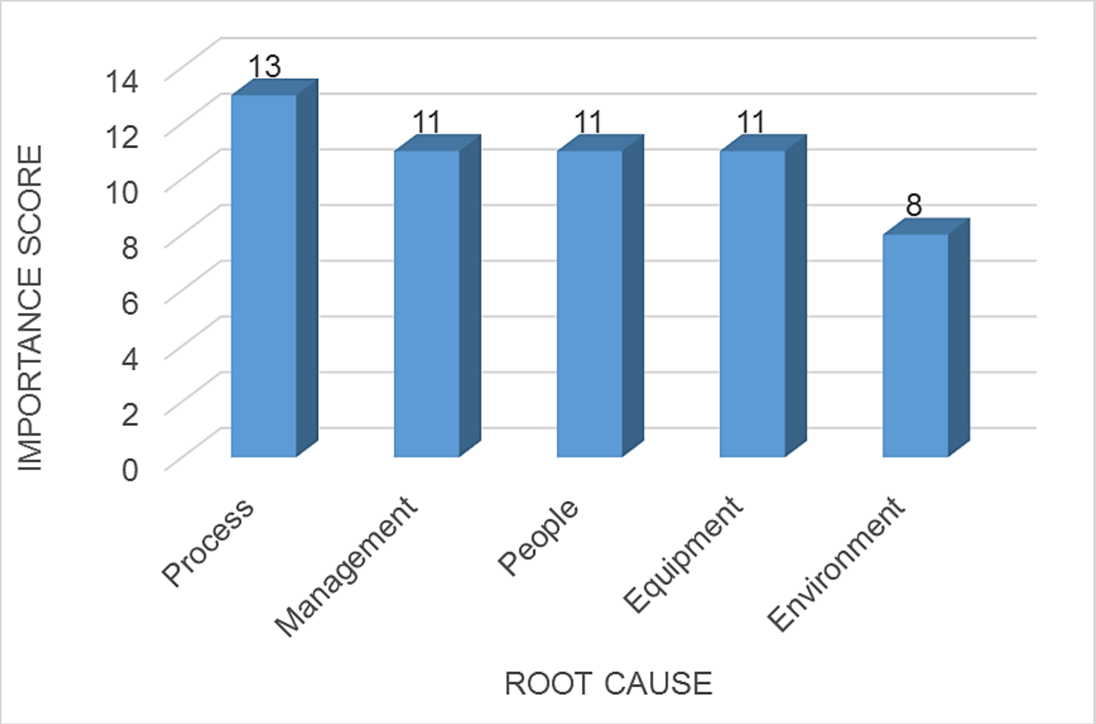


Figure 4.5: Ranking of delay factors

Source: Author (2017)

4.4 Results Analysis and Discussion

The assessment that was carried out to determine the schedule slippage causes in telecommunication projects in Zambia revealed that process related factors ranked highest with a score of thirteen followed by schedule management, people and equipment-related factors with a score of eleven. It also revealed that environment related factors have least adverse effect on the project schedules with a score of eight. The results also revealed that the factors viewed to have high impact are generally the more frequent ones. It was also noted that the effect of failure in one stage of the project is normally only visible in subsequent stages. This may lead to the team addressing the effects and not the root causes of the delay. It might explain why there is still a lot of delays experienced even with advanced software and methods of managing projects. The respondents stated that if planning is done correctly, the rest of the project runs smoothly as any risks will have been identified and planned for at an early stage.

4.4.1 Management-related delay factors

Management related delay factors can be directly attributed to the failure by the project manager to effectively superintend over the project. Results in Figure 4.6 show that poor stakeholder identification and involvement and unclear project scope were the highest ranked management related delay causes. The interviewees pointed to a poor stakeholder engagement, especially at an early stage as the cause for poorly developed schedules. According PMBOK® Guide (PMI, 2008), stakeholder identification is the first step of the stakeholder management knowledge area done during project initiation phase. The effect of stakeholder involvement cannot be over-emphasised. Involving the customers and other stakeholders during initiation generally improves the probability of shared ownership, deliverable acceptance, and customer and other stakeholder satisfaction (PMI, 2008). The same applies to unclear scope, as most of the proceding knowledge areas depend on the scope management. An ecxerpt from one respondent:

"We need to improve stakeholder identification and engagement at an early stage and use their feedback as input into schedule development" (Deployment Manager, Airtel Zambia, 2017).

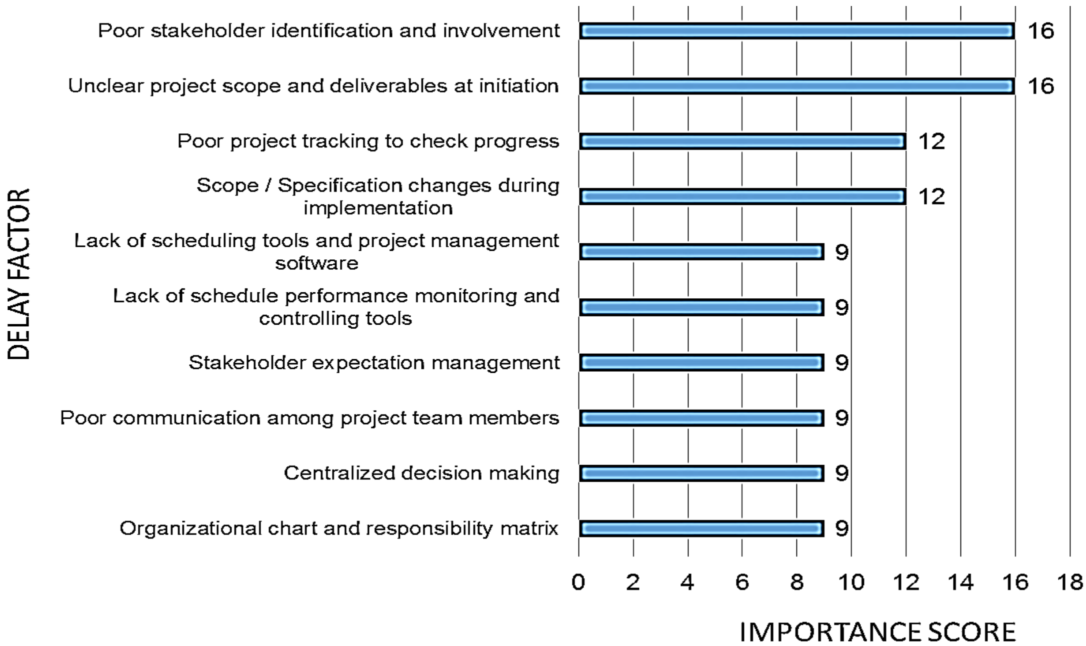


Figure 4.6: Ranking management related causes

Source: Author (2017)

4.4.2 Process related delay factors

For process related delays, Figure 4.7, the results show that a flawed schedule development process and poor information gathering before timelines are decided are the main contributors. Under-estimation of activity duration and over-optimistic estimates both highlight the tendency by project managers and sponsors to overestimate benefits and underestimate negatives. This was pointed out by Flyvbjerg (2011) in his study of root causes of overruns in major projects. Under-estimation of activity duration is a consequence of what he termed “optimism bias”, a tendency by managers to make decisions based on “delusional optimism rather than on a rational weighting of gains, losses, and probabilities”. Over-optimistic estimates are “principal-agent problems”, where top management push for project completion as quickly as possible (Flyvbjerg ,2011). However, the uncontrolled pressure risks the quality of the work, resulting in reworks and failure at closeout (acceptance) stage.

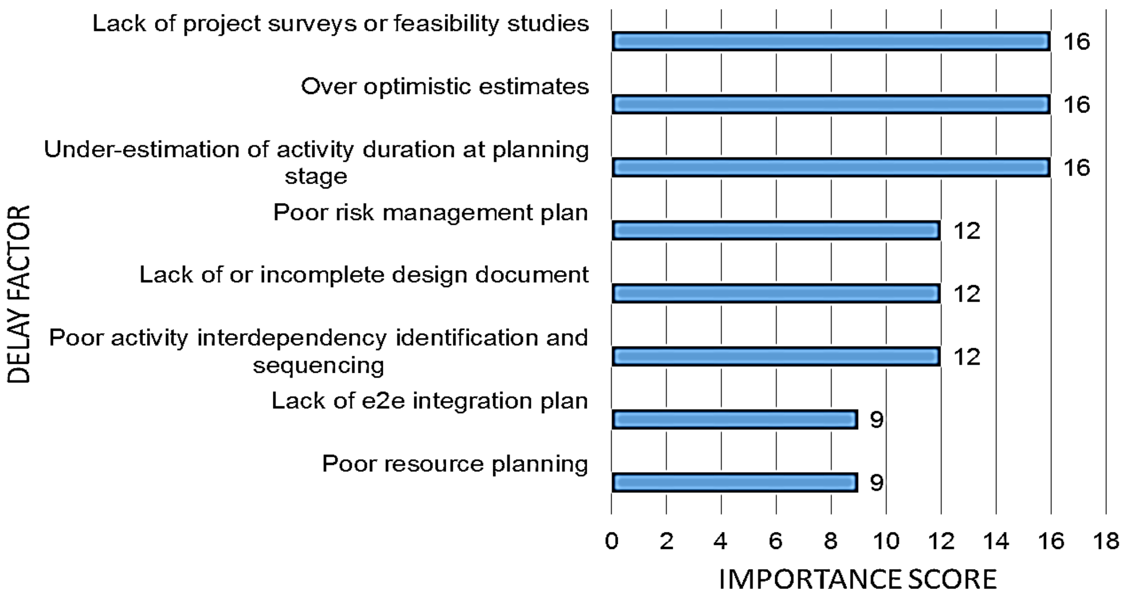


Figure 4.7: Ranking process related delay causes

Source: Author (2017)

4.4.3 People related delay factors

The standout contributor is the lack of dedicated project teams for most of the telecommunication projects, as shown in Figure 4.8. Aminah & Chai (2013), categorised these as structural causative factors where teams can either be appended, stand-alone or partnership structure. Operations teams are involved in project activities, resulting in the following:

- the project manager has no complete control over the team, and relies on the functional managers for availability of the resources;
- it results in conflicting / competing priorities between operational and project activities. Operations teams tend to rank operational activities higher, as this is their main key performance measure; and
- the added workload over-stretches the operational teams, resulting in inefficiency in both operational and project activities.

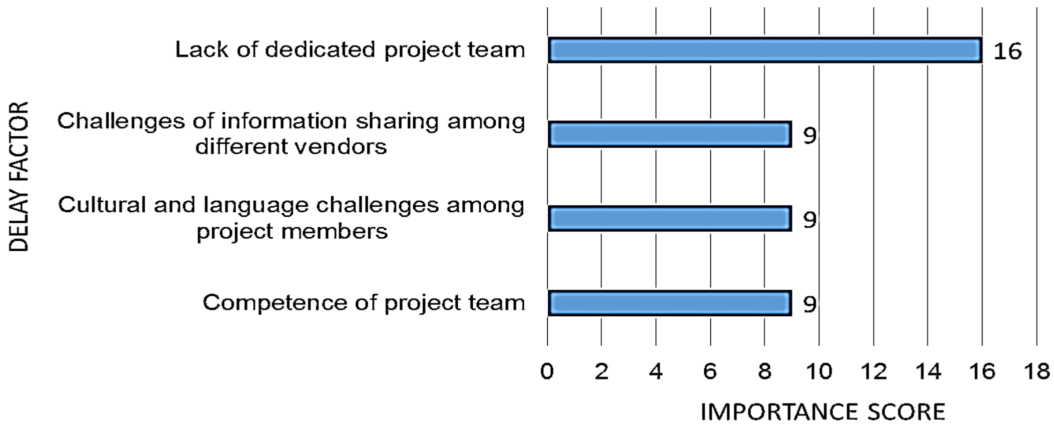


Figure 4.8: Ranking **p**eople related delay causes

Source: Author (2017)

4.4.4 Equipment related delay factors

Late delivery of project materials and a long procurement approval process were cited as the main contributors under equipment related delays. This points to the failure in the "Conduct Procurement" and "Control Procurement" during the project execution and monitoring and control respectively, as guided by PMBOK® Guide (PMI, 2008).

Interview results showed that there is usually a disconnect between the project team and the supply chain management (procurement) team, and the two may not attach the same priority to the project. Late delivery of materials was attributed to logistical challenges in shipment of materials, warehousing processes and inefficiencies in the equipment suppliers. An interview excerpt below on what need to be done to close this gap highlights this.

"Improve collaboration between network and procurement departments on team selection, approval process and ensure rating of suppliers to be strictly enforced and adhered to." (Planning Manager, Airtel Zambia, 2017).

Figure 4.9 shows the scoring and ranking of equipment related delay causes.

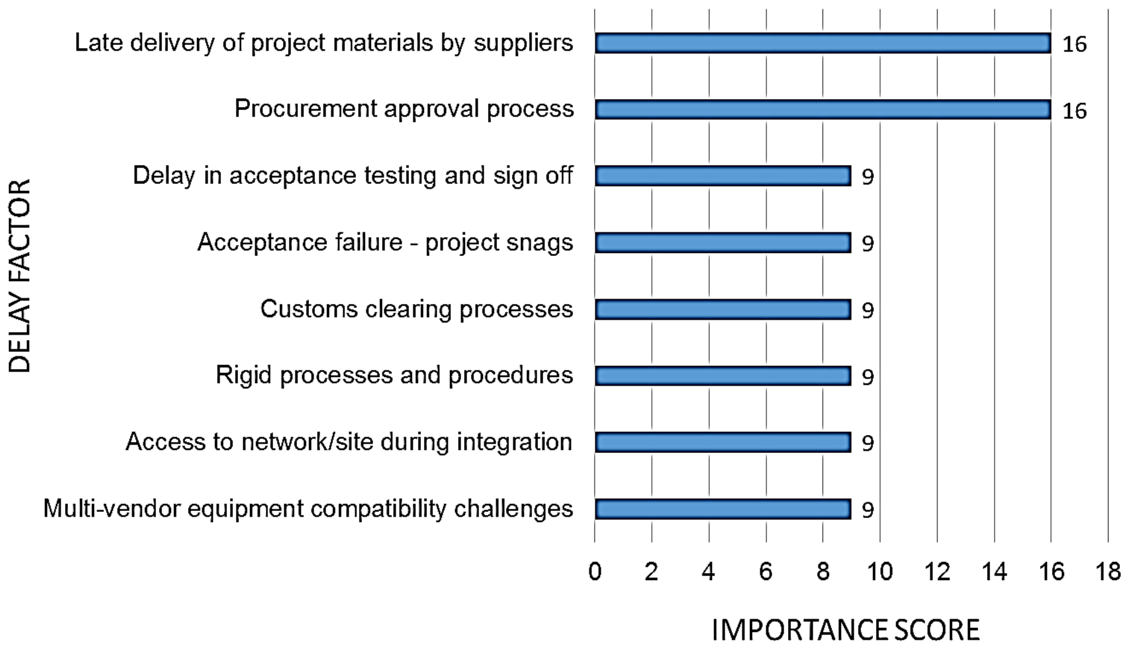


Figure 4.9: Equipment related delay causes

Source: Author (2017)

4.4.5 Environment related delay factors

The results obtained show that environment related factors affect the project schedule the least. This is highlighted in Figure 4.10 where the highest ranked factors are support infrastructure availability and space acquisition and preparation, with score of nine. The low score of environmental factors shows the differences between construction and telecommunication projects, as highlighted by Sherif (2006) and Taylor (2004).

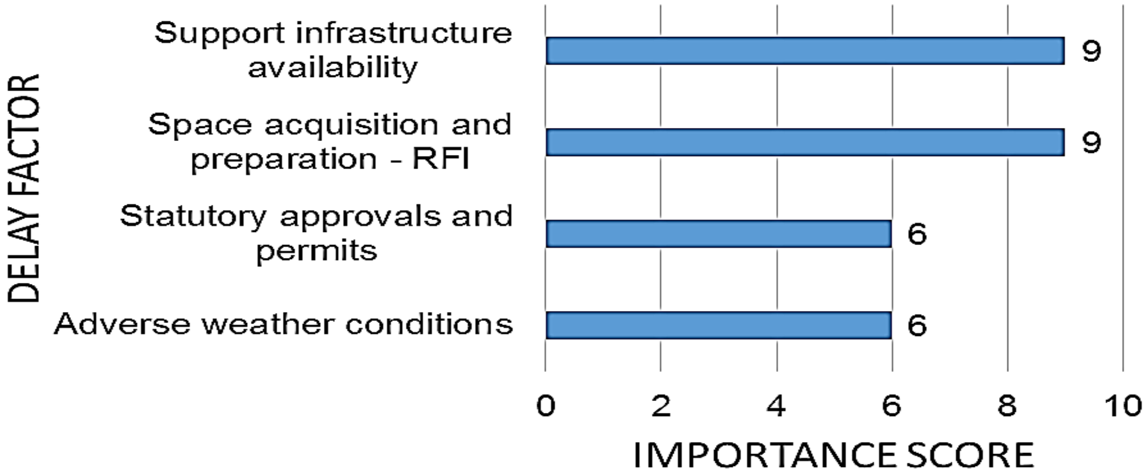


Figure 4.10: Ranking environment related delay causes

Source: Author (2017)

4.4.6 Comparison of interview and questionnaire results

A comparison between the responses obtained from the interviews and questionnaire to identify any gaps that exists between the project managers (experts) and the rest of the project team. From the results it was observed that overall the results in agreement about the main causes of delays. Procurement is ranked high from the interviews and questionnaire survey, whereas schedule development and scope management (questionnaire) are part of the project planning identified during the interviews. Even though stakeholder management is ranked not in top four on the questionnaire responses, and thus not captured, it ranks fifth, showing consistence with the interview responses. Figure 4.11 shows the top four from each data set. However, there is a gap on organization and design. Whereas the interviews ranked organization of the project team high, it was ranked lowly by the questionnaire respondents. Also design related factors were ranked highly by the questionnaire respondents, it was ranked low during interviews. The gaps could be explained by the way time management is done e.g. the top-down approach and less involvement of all key stakeholders at an early stage.

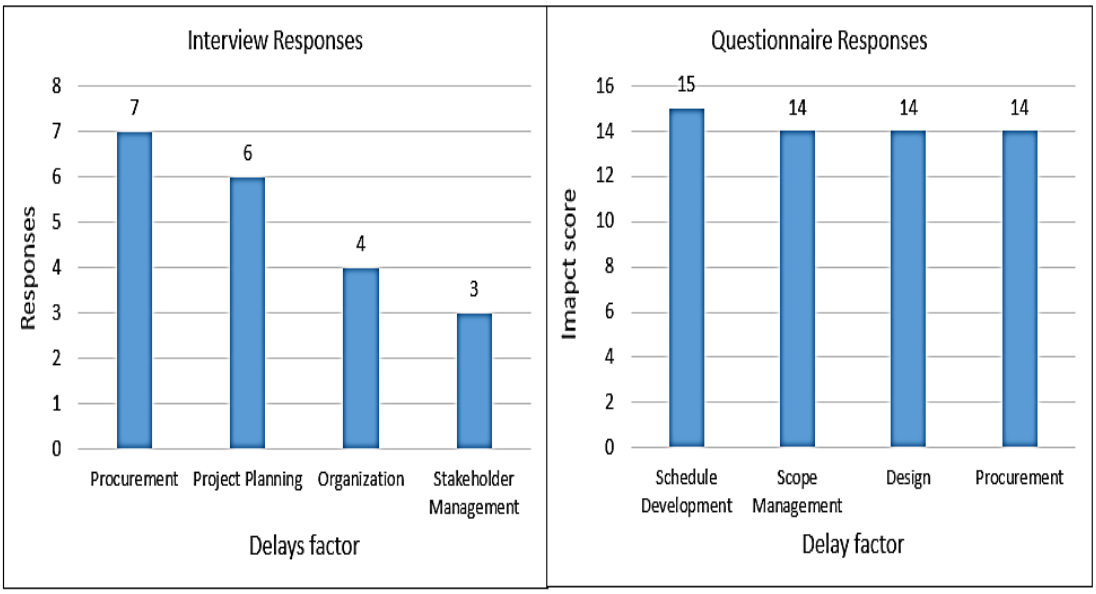


Figure 4.11: Comparison of interview and questionnaire results

Source: Researcher's Field Survey Analysis (2017)

It was discovered that both interview and questionnaire respondents ranked team competence and composition, monitoring and control, integration challenges and RFI readiness lowly. This shows that even if there are slight gaps on the perception of the delays, overall the professionals know what causes the delays, and possibly the remedies.

4.4.7 Discussion of responses with respect to objectives

The results obtained from the semi-structured interview and questionnaire helped to answer the research objectives. Four research objectives were set out to be studied in order to answer the research question.

i. The first objective was to establish factors that lead to schedule slippage in mobile telecommunication projects. This involved studying available literature to establish the general characteristics of delays experienced in the ICT projects. To get an on-the-ground experience, an interview was carried out with stakeholders directly involved in telecommunication projects in Zambia. From the results of the survey, procurement ranked highest followed by project planning and organization related issues. During interviews, follow up questions were used to pinpoint the actual cause of the delays. This helped in mapping the causes to come up with the fishbone diagram, the approach that was adopted in this research. Thirty-four factors (activities) that lead to project delays were identified.

ii. The second objective was to categorise identified delay factors. The causes were divided using a three-tier method where variables, constructs and dimensions were mapped as shown in Table 4.1. The mapping in Table 4.1 formed the basis for the development of the fishbone diagram, with five generic causes: management, people, process, equipment and environmental factors as shown in Figure 3.3. The three-tier approach enables the team to address the factors at the three levels – operational, managerial and strategic – thus improving effectiveness of solution implementation.

iii. The third objective was meant to evaluate the impact of the delay factors, ranking them according to their relative factor importance. To do this, quantitative analysis was required and a questionnaire was developed based on the fishbone diagram (Figure 3.3). From the results obtained, it was observed that "Process" related factors were ranked highest while "Environment" related factors had the lowest ranking. Analyzing the contributors revealed that there is a general problem of insufficient initial analysis of projects. This leads to the challenges in the design and schedule development, scope definition and stakeholder management.

4.5 Summary

The analysis and discussion of the results with respect to the categories and objectives was done in this chapter. The next chapter presents the conclusion derived from the results and the recommendations to curb delays in telecommunication projects in Zambia.

CHAPTER 5 : CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The main aim of the study was to investigate the causes of project delays in telecommunication industry in Zambia. Specific objectives followed to achieve the goal were to (i) identify the causes of delay, (ii) categorise them according to their generic nature; and (iii) evaluate and rank them according to their perceived impact on the project schedule.

The basis of the research was discussed in Chapter 1, literature reviewed in Chapter 2, the research approach adopted for this research in Chapter 3 and results were presented in Chapter 4. This chapter sums up the research by presenting the conclusion and recommendations derived from the results obtained.

5.2 Conclusion

To improve schedule control in telecommunication projects in Zambia, it is important that the main contributing factors are identified and categorised. This research has identified and, based on the quantified factor importance indices, determined the influence ranks of thirty-four (34) factors causing delay in telecommunication projects in Zambia.

Project delay causes can be grouped into distinct categories to make it easy to analyse and manage them, and this approach helps identify the root causes of the problem. The fishbone diagram categorised the delay causes into process, management, people, equipment and environment related factors.

From the results obtained it was concluded that the top eight factors negatively impacting telecommunications project schedules overrun are: (1) Unclear project scope and deliverables at initiation; (2) Poor stakeholder identification and involvement; (3) Under-estimation of activity duration; (4) Over-optimistic estimates; (5) Lack of project surveys or feasibility studies; (6) Lack of dedicated project teams; (7) Procurement approval process; and (8) Late delivery of project materials by suppliers.

At a higher level, it was concluded that projects overrun their schedules mainly because of the processes that govern time management in companies. This is attributed to the flaws in the early stages of the project, and these are responsible for most the delays that are experienced during the later stages of the project. Factors related to management, people and equipment also highly impact the project schedules while, as anticipated, it was established that environmental factors have minimal impact on the project schedule.

5.3 Recommendations

This research endeavoured to identify the root causes of delay in telecommunications projects in Zambia. A comparison of the interview and questionnaire results showed that both project experts and other telecommunication practitioners agree, to a large extent, on what the problem is. From this perspective this research has opened up a number of interesting questions as to why overruns are still experienced, even when professionals know the cause of the problem. To obtain the details of the "failed" projects, a case study research approach can be adopted.

Based on the results and conclusion of this research, the following recommendations are proposed to avoid occurrence of the delays and to manage them when they eventuate,

i. Improve project planning

The importance of planning cannot be over-emphasised; six of the seven time management processes have to do with planning. There is strong linkage among the identified delay factors, and a failure in one may have adverse effects on the rest of the project schedule. The following specific recommendations are put forward to address the project planning.

- Adopt the bottom-up approach to planning, through brainstorming sessions. It is important to get the project requirements correct during initiation phase as this is the bedrock of the latter project phases. The project manager should identify and engage key stakeholders of the project and use their feedback as input into the project schedule. The improved requirements collection and stakeholder engagement will result more realistic schedules which are accepted and owned by the whole team.
- Another method of improving project planning is to harness the use of knowledge management practices. Most of the telecommunication projects are similar in nature and learnings from previous projects can be used as valuable input into the planning process. Organisational process assets should be consulted to obtain any learnings from previous projects.

ii. Improve project activity co-ordination

The competence and experience of the project manager is important for project success. From the results, it was identified that either the project managers (PM) do not have the required experience or the power to control the activities of the project. The PM should have enough control to ensure over- and under-estimates do not occur during schedule development. There should be incentives for procurements and works done ahead of schedule, as well as penalties for delays at any phase.

iii. Adopt modern management approaches – the Talent Triangle

With the evolved business models in today's competitive global economy, network operators need to invest in key skill sets that look beyond technical skills and adopt competencies that support and sustain long-range strategic objectives. This also improves the business linkages within the organisation and with organisations. To address the identified factors, the PMI Talent Triangle (PMI, 2017) has been recommended to be adopted by the companies to enhance project time performance.

Figure 5.1 shows the talent triangle. By embedding the talent triangle principles into the organisational culture, employees broader perspective of the business resulting in goal congruence across the organisation.

Figure 5.1: Project Talent Triangle
Source: PMI (2017)

- Technical Project Management includes knowledge and behaviors related to specific domains of project, program and portfolio management.
- Leadership is the ability to lead and develop a team and to show appropriate behavior in dealing with the various stakeholders.
- Strategic and Business Management is the knowledge of and expertise in the industry or organization that enhances performance and better delivers business outcomes.

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APPENDICES

Appendix I: Cover Letter

The University of Zambia

School of Engineering

Department of Civil and Environmental Engineering

P. O. Box 32379, Lusaka.

Cell: +260978980082; Email: esibalwa@yahoo.co.uk

January 10, 2017

Dear Sir/Madam,

I am conducting a research on the causes of delays in telecommunication projects in Zambia, in fulfilment of Master's Degree in Project Management.

Kindly assist with the attached questionnaire, by marking an "X" on the choice that closely represents your opinion.

The questionnaire has three parts: Personal Information, Frequency of occurrence and Impact of the occurrence. Consider the project duration from initiation to closeout.

For any queries, get in touch with the undersigned or the research Supervisor

Thank you in advance for your time and kind cooperation.

Yours Faithfully,

EPHESO SIBALWA (Master of Engineering Student)

Supervisor: Dr Erastus Mwanaumo (0969561353)

Email: Erastus.mwanaumo@unza.com

Appendix II: Interview

Please indicated your consent by ticking in the ‘Yes or No’ the box below.

I hereby give my consent to take part in the research study as detailed in this questionnaire.

Yes ☐ **No** ☐

SECTION A: Biographical Data

Tick where applicable

1. What is your gender? ☐ Female ☐ Male

2. What is your organization’s business in Telecommunication industry?

☐ Mobile Network Operator ☐ Vendor ☐ Contractor

☐ Others; Specify ___________________

3. What best describes your daily role in your organization?

☐ Project Deployment ☐ Design (Planning / Optimization)

☐ Operations ☐ Others; Specify______________________

4. How long have been working on Telecommunication projects?

☐ < 3 ☐ 3 – 7 ☐ 8 – 11 ☐ > 11

SECTION B: Project Time Management

Answer the questions below, according to your personal experience

i. From your experience what are the main causes of delays in telecommunication projects?

____

____

____

ii. What measures would you put in place to improve time keeping in telecommunication projects?

____

____

____

iii. Any additional comments or suggestions

____

____

____

The End!

Thank you for your participation in the interview.

Appendix III: Questionnaire

Rank the following causes with regards to their Frequency and Severity by marking in the appropriate space provided. The range of weighting is from 1 to 5 as shown in the table below.

Scale	Frequency	Impact
1	Never	None
2	Rarely	Low
3	Sometimes	Moderate
4	Frequently	High
5	Always	Very High

#	CAUSE OF DELAY	FREQUENCY					IMPACT				
		1	2	3	4	5	1	2	3	4	5
1	Unclear project scope and deliverables at initiation										
2	Scope / Specification changes during implementation										
3	Organizational chart and responsibility matrix										
4	Centralized decision making										
5	Poor stakeholder identification and involvement in project schedule development										
6	Poor communication among team										
7	Stakeholder expectation management										
8	Poor project tracking to check progress										
9	Lack of schedule performance monitoring and controlling tools										
10	Lack of scheduling tools and project management software										
11	Poor activity interdependency identification and sequencing										
12	Under-estimation of activity duration at planning stage										
13	Over optimistic estimates e.g. pressure from management to get things done quickly										
14	Lack of project surveys or feasibility studies e.g. poor information available at planning stage										
15	Lack of or incomplete design document										
16	Poor resource planning										
17	Poor risk management plan (Failure to identify likely risk in the project plan)										
18	Lack of E2E integration plan										
19	Competence of project team										
20	Lack of dedicated project team i.e. staff combine operations and project roles										

Questionnaire *Continued*

21	Cultural and language challenges among project members										
22	Challenges of information sharing among different vendors										
23	Multi-vendor equipment compatibility challenges										
24	Access to network/site during integration										
25	Rigid processes and procedures e.g. changes allowed only during specific time of day										
26	Procurement approval process										
27	Late delivery of project materials by suppliers										
28	Customs clearing processes										
29	Acceptance failure - project snags										
30	Delay in acceptances testing and sign off										
31	Adverse weather conditions										
32	Statutory approvals and permits										
33	Space acquisition and preparation										
34	Support infrastructure availability e.g. power										

Appendix IV: Analysis of delay factors (average scores)

ID	DIMENSION (Primary)	CONSTRUCT (Secondary Cause)	VARIABLE (Tertiary Cause)	Tertiary Mean Score			Secondary Mean Score	Primary Mean Score
				FI	SI	FII		
1	Management	Scope Management	Unclear project scope and deliverables at initiation	4	4	16	14	11
2			Scope / Specification changes during implementation	3	4	12		
3		Organization	Organizational chart and responsibility matrix	3	3	9	9	
4			Centralized decision making	3	3	9		
5		Stakeholder Management	Poor stakeholder identification and involvement	4	4	16	11	
6			Poor communication among project team members	3	3	9		
7			Stakeholder expectation management	3	3	9		
8		Monitoring & Control	Poor project tracking to check progress	3	4	12	10	
9			Lack of schedule performance monitoring and controlling tools	3	3	9		
10			Lack of scheduling tools and project management software	3	3	9		
11	Process	Schedule Development	Poor activity interdependency identification and sequencing	4	3	12	15	13
12			Under-estimation of activity duration at planning stage	4	4	16		
13			Over optimistic estimates	4	4	16		
14		Design	Lack of project surveys or feasibility studies	4	4	16	14	
15			Lack of or incomplete design document	4	3	12		
16		Project Planning	Poor resource planning	3	3	9	10	
17			Poor risk management plan	3	4	12		
18			Lack of e2e integration plan	3	3	9		

Appendix IV *Continued*

19	People	Project Team	Competence of project team	3	3	9	11	11
20			Lack of dedicated project team	4	4	16		
21			Cultural and language challenges among project members	3	3	9		
22			Challenges of information sharing among different vendors	3	3	9		
23	Equipment	Integration Challenges	Multi-vendor equipment compatibility challenges	3	3	9	9	11
24			Access to network/site during integration	3	3	9		
25			Rigid processes and procedures	3	3	9		
26		Procurement	Procurement approval process	4	4	16	14	
27			Late delivery of project materials by suppliers	4	4	16		
28			Customs clearing processes	3	3	9		
29		Functionality UAT	Acceptance failure - project snags	3	3	9	9	
30			Delay in acceptances testing and sign off	3	3	9		
31	Environment	Weather conditions	Adverse weather conditions	2	3	6	6	8
32		Regulatory approvals / permits	Statutory approvals and permits	2	3	6	6	
33		Ready For Installation (RFI)	Space acquisition and preparation - RFI	3	3	9	9	
34			Support infrastructure availability	3	3	9		

Source: Researcher’s data analysis (2017)