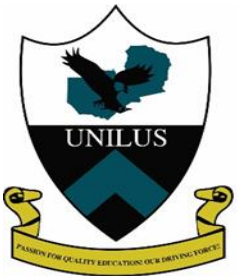

UNIVERSITY OF LUSAKA

SCHOOL OF POSTGRADUATE STUDIES

FACTORS AFFECTING THE ADOPTION OF INFORMATION COMMUNICATION TECHNOLOGY FOR PROJECT MANAGEMENT IN THE CONSTRUCTION INDUSTRY IN LUSAKA.

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, UNIVERSITY OF LUSAKA IN PARTIAL FULFILLMENT OF THE AWARD OF THE MASTER OF SCIENCE IN PROJECT MANAGEMENT.

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SCHOOL OF POSTGRADUATE STUDIES

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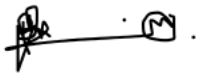

Signature of student:

Date: 1st January 2024

Supervisor's Comments:

I recommend/ do not recommend this dissertation for submission for examination (If you do not recommend, kindly provide a written report and attach hereto).

Name of Supervisor: Mr. EMMANUEL MWANAKATWE

Signature of Supervisor: …

Date: 2nd January 2024

DECLARATION

In order to receive a Master of Science degree in Project Management, I, REGGO MASIYE, student number MSCMP21210257, hereby declares that this dissertation, titled Factors Affecting the Adoption of Information Communication Technology for Project Management in the Construction Industry in Lusaka, is my original work.

Furthermore, aside instances in which credit has been given throughout the text, to the best of my knowledge, this dissertation does not contain any material that has been published by another individual or that has been authorized for the awarding of any other Master of Science degree at any university. I hereby acknowledge that I am solely responsible for any mistakes or shortcomings in the dissertation.

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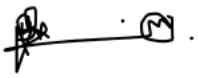
Signed : 

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Date 2nd January 2024

DEDICATION

To my parents, Gilbert P.C Masiye and Agnes Rego, I dedicate this report to you.

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I am thankful to the all-powerful God for giving me the opportunity to get this far in my academic career.

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ICT	-	Information Communication Technology
IT	-	Information Technology
MS	-	Microsoft
SMEs	-	Small and Medium Scale Enterprises

ABSTRACT

The increasing integration of Information and Communication Technologies (ICTs) into project management methods is causing a paradigm shift in the construction sector. ICTs can change lives by facilitating better collaboration, communication, and project delivery. However, there exists limited knowledge concerning the extent of use of software ICT applications in project management by SMEs within the construction industry in Lusaka. This research, titled "Factors affecting the adoption of ICTs for project management in the construction industry in Lusaka," sought to determine the factors affecting the adoption of ICTs in the construction industry.

The research was conducted using a mixed-methods approach, making use of both quantitative and qualitative methods. Data was collected through a survey via google platform with 30 purposively selected practitioners involved in the construction industry. Respondents identified factors affecting the adoption of ICTs for project management through a series of closed-ended questions, they also provided responses on challenges in adopting ICTs for its own projects. open-ended questions were utilized where respondents provided proposals on measures to put in place to enhance the adoption of ICTs in the construction industry in their projects management. Statistical techniques like frequency were analyzed with Google Sheets and Microsoft excel was used to visually present the data in charts.

The results concluded the existence of a gap between awareness and utilization ICTs among the players on projects. the majority of the respondents (63%) indicated inadequacy of skills to use ICTs during projects, this was followed by inadequacy of capacity building programs with 50% of the respondents indicating the need for measures to be put in place to address the challenge. The study showed that there is need for capacity building of employees on existing ICTs that can be used on projects. This can be done through workshops. In addition, the need for Top management support in ensuring that employees adopt ICTs was suggested by the respondents. This can be achieved through change management support programs, and financial investment on procurement of software. Furthermore, the involvement of employees in the selection of software provides for a sense ownership and subsequently improves adoption of procured ICTs. Other measures proposed towards the adoption of ICTs included investment in seminars and workshops on

new and emerging technologies that enhance the management of projects in the construction industry, support from developers on software procured, and the development of policies that enhance the use of ICTs.

The study contributed to the existing literature by providing an insight into fostering inclusive ICT strategies which were practical towards enhancing the adoption of ICTs for effective project management in the construction industry. It also stressed the importance of addressing People, Process and Technology in a holistic manner towards the adoption of ICTs and recommends the application of the proposed strategies.

KEYWORDS: Factors affecting adoption of ICTs, Construction Industry, Top management support, Capacity building, Measures to incentivize use of ICTs.

CHAPTER ONE
INTRODUCTION

1.1. Background to the study

The Project Management Body of Knowledge (PMBOK, 2008) defines project management as the application of knowledge, skills, tools, and techniques to project activities to meet project requirements (ibid p. 6), accomplished through five process groups. These process groups are initiation, planning, execution, monitoring and control, and closing (ibid p. 6). Further, the fundamental component of project management is striking a balance between the conflicting project constraints of scope, quality, time, money, resources, and risk (ibid p. 6). Generally, capital projects gobble substantial sums of monetary resources, but evidence also abounds that indicates that over 75 percent capital projects experience budget overruns, and that more than half experience budget overruns in excess of 50 percent (PwH, Successful capital project delivery report, n.d).

The construction industry has long been considered among the largest investments worldwide with significant influence on economic development (Sylvia, 2017). There has been a rise in the adoption of Information Communication Technology (ICT) over the years regarding addressing the challenges related to the management of projects in the construction industry. These have been aimed at improving project performance through the use of appropriate tools and techniques (Lekan, 2018).

The application of ICT to project activities is among the tools that drive the success of projects in Construction (Eliwa, 2022). In relation to construction projects, it encompasses the use of decision support tools using computer software and hardware for processing and analysis of information throughout the project (Paudyal, 2018).

Project management in the construction industry faces various barriers during implementation and ICT has been seen to be among the drivers towards mitigating some of the challenges experienced (Moshood, 2020). Hassan (2019) identifies seven factors to the adoption of ICT for project management in the construction industry namely; administrative, financial, cultural, human, legal, technical, and security factors. Over the years, the delays in line with the delivery of projects in the construction industry have been seen to be a global challenge and have had a significant impact on delivering projects on time, and on budget, and have compromised the quality of projects (Fashina, 2021). The construction industry has

had an unsuccessful track record in the implementation of modern technological developments. This has resulted from the complexity and nature of projects in the construction industry (Liu, 2023). The adoption of ICTs has a subsequent impact on the performance of projects in the construction industry and there has been an increasing need to have immediate information, increased data processing, and the utilization of software and hardware to carry out tasks. However, the construction industry faces challenges with improving work practices to become more competitive and become more client-oriented through the adoption of ICT. The introduction of models such as the Building Information Model (BIM) has enabled many companies and institutions to obtain a competitive advantage in the industry and has led to the improvement in the delivery of construction projects through robust stakeholder engagement on projects from inception to completion (Sagini, 2016). ICT tools are important in the support of project operations. ICT infrastructure supports the performance of projects at various levels in the organization. Research suggests a positive correlation between the implementation of ICT and project performance (Eliwa, 2022).

In Zambia, Technology has been identified to play an important role in the desire to achieve economic transformation with Zambia Information and Communications Technology reporting an increased demand for ICT services (Zambia Information and Communications Technology Authority, 2022). The adoption of ICTs for project management affects different players in the project management process between the initiation and completion of the project which ranges from the complexity of ICT, and availability of resources, to costs associated with the procurement of ICTs aimed to improve the rate of success in the delivery of a project through the integration of various tools to project processes. To appreciate the existing and new technologies, it is imperative that institutions put in place measures to allow for the use of ICTS as well as establish an understanding of the barriers to the adoption.

1.2. Statement of the Research Problem

The adoption and automation of business processes through use of information systems has been identified as the core driver of efficiency and value optimization across economic sectors including the construction industry. The rapid growth in ICT utilization and integration into business processes, however, comes with various requirements necessary to maximize its utilization (Khudzari, 2021). A report

produced by the African Conference on Information Systems and Technology (2022) highlighted the lack of ICT knowledge, high acquisition costs, unreliable and inadequate infrastructure, ease of use and perceived usefulness as some factors that continue to affect its adoption (ibid p. 2). Evidence indicates that the digital economy accounts for slightly over 15.5 percent of the world's GDP (World Bank, 2020), and that the adoption of digital technologies in business processes across sectors bears significant outcomes on general work productivity (African Union, 2020).

The consequences on ICT adoption in construction leads to inadequate stakeholder collaboration, impacting decision-making and causing inefficiencies. Underutilization of ICT tools hampers resource management, missing out on competitive advantages, real-time tracking, safety, and compliance. Manual methods increase errors, rework, expenses, and project delays.

In developing nations like Zambia, public infrastructure, mainly led by the public sector, (Cheelo and Liebenthal, 2020), attracts well-resourced foreign construction firms, including those equipped with ICT capabilities (RDA, 2015; NRFA 2015; NCC 2017). However, limited understanding exists regarding SMEs' usage of software ICT applications in project management within Zambia's construction sector. Despite potential benefits, ICT tool adoption remains inconsistent among construction companies, prompting inquiry into the complex factors influencing its use for project management in the industry.

The purpose of this study is to look into the complex interactions that influence how ICT is being adopted for project management in the construction sector. Through an analysis of organizational, technological, environmental, and individual factors, this research aims to clarify the fundamental obstacles and enablers that impact the adoption of information and communication technologies. Moreover, it seeks to pinpoint tactics and measures that can effectively encourage the broad adoption of ICT technologies for the purpose of optimizing project management procedures in the construction projects.

1.3. Research Objectives

1.4. Main objective

The main objective was to determine factors that affect the adoption of ICTs for project management in the construction industry in Lusaka, Zambia

1.5. Specific Objectives

The specific objectives are;

i. To identify factors affecting the adoption of ICT in project management for construction projects in Lusaka.
ii. To analyse the extent the identified factors affect project performance in the construction industry;
iii. To recommend appropriate strategies for the adoption of ICTs for project management in the construction industry.

1.6. Research Questions

i. What are the factors that affect the adoption of ICT in project management in the construction industry?
ii. Why does the construction industry have challenges adopting use of ICTs for its own projects management?
iii. How can the construction industry be incentivized to adopt use of ICTs for project management in its own industry?

1.7. Significance of the study

This study was significant to the construction industry in that it provided an analysis of the factors that are affecting the adoption of ICTs in project management with a focus on the construction industry, the extent of the use of ICTs as well as a practical approach to the measures that can be put in place by all the stakeholders involved in the construction industry which include Project Management Officers Civil Engineers, Suppliers Architects, Consultants, and IT advisors to enhance the adoption of ICTs for project management in the industry.

The study conducted by Mwape and Ndihokubwayo (2010), on investigating the level of Information Communication Technology (ICT) uptake in the Zambian Construction

only focused on a limited number of ICTs namely electronic -mails (e-mail), short messaging systems (SMS) and interactive websites. The study paved way for exploration of a wider variety of ICTs and the factors affecting the adoption putting into consideration the benefits that digitization has brought to other sectors. The significance of the research was also fill this gap and add to the body of knowledge.

The study provided the extent of the utilization of ICTs, as it provided awareness against the utilization of ICTs to provide a gateway towards bridging this gap. Further, it provided a practical approach towards measures that could be put in place to enhance the adoption of ICTs as well as areas to focus on based on the responses from management among institutions. The results provided for an insight on the need for policymakers to incorporate ICTs so as to enhance the adoption into their processes as well as a review of curriculum in learning institutions to incorporate ICTs so as to enable graduates have the necessary ICTs skills on software applications used in industry.

The adoption of the proposed measures would significantly reduce errors, streamline processes and minimize rework which all ultimately contributes towards staying within the budget. Further, adoption of the measures would enhance communication and coordination among stakeholders, and task management thereby reducing delays and project completion dates in the management of projects.

The results of the study provided for an understanding on the extent which top management play in the adoption of ICTs and their relevance during the change management process. The study identifies them as essential players in driving change management processes as it compasses facilitation of a change in work processes and procedures, managing resistance among different stakeholders.

In addition, the results of the study paved way for establishing measures to be put in place in in line with establishing a baseline on the technology readiness for the adoption of ICTs in relation to AI for project management in the construction industry. Professional bodies such as the National Council for Construction would benefit from the findings as these will be an eye-opener in identifying the prevailing situation with empirical evidence on the adoption of ICTs and their usage in the industry.

1.8. Scope of the study

The scope of this study focused on the adoption of ICTs for project management in construction industry, in both public and private organizations in Lusaka. The focus narrowed down to understanding the factors that lead to the factors affecting the adoption of ICTs. The data collection instruments for the study was a survey questionnaire for data collection considering a qualitative approach that will be used to conduct the research.

Participants were drawn from the target population in the construction industry which included Project Management officers in project offices (PMOs), Architects, Civil Engineers, Consultants, and project executives. The selection of these players as they play a central role in that their roles encompass design, execution, resource provision, and project oversight, respectively. Understanding their perspectives on ICT adoption elucidates challenges and opportunities across the project lifecycle. This diverse representation ensures a comprehensive analysis of factors influencing ICT adoption, contributing to effective implementation strategies in the construction industry.

Purposeful sampling was used for the study. The selection of this sampling method helped narrow down and focus on the target population. The selection of the different players was important as it provided for a holistic approach towards the analysis with an understanding that the adoption of ICTs affect the overall quality and management of projects.

1.9. Definition of key terms and concepts

Information communication technology: ICT refers to the various tools, systems, hardware, and software, which are used to deliver project success as well as communicate with stakeholders on a project.

Project management: This is the application of knowledge, tools and techniques toward project activities to meet project requirements (PMBOK 2017). It is the temporary endeavor undertaken to create a unique product or service.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

The introduction of Information and Communication Technologies (ICTs) has caused an industrial revolution in the building industry globally. Since its implementation, construction processes have significantly improved in areas such as time, quality, expenditure, and satisfaction of clients (Paudyal and Prakriti, 2018). The adoption and use of ICTs permeates all aspects of economic life and in many ways, ICTs have been heralded as efficient drivers of business process (Onyedimekwu, Okechi and Memoye, Oruan, 2022), enabling business visibility and access to markets across geographical boundaries (Deloitte,2019). Automating, and integrating business processes firm-wide is, therefore, key to the efficient operation of the contemporary firm and ultimately in maintaining its competitive edge (Mwanakatwe, 2021, p. 100). ICTs are currently adapted for use across industries and the construction sector has not been left out on this score. Forecasted statistical data from Global Data report (2023-2027) indicate that there has been some change in the market size in the construction industry, its trends, and progress by key countries and regions; that global construction grew by 2.1% in real terms in 2022, a slower pace of growth than the 3.8% rise seen in 2021 (https://www.worldconstructiontoday.com/news/construction-industry-to-experience-slow-growth-in-2023). Nevertheless, the weakness in the Zambian construction industry can be tracked to have existed before the Coronavirus (COVID-19) outbreak. The introduction of the coronavirus, however, intensified by 2020. In this regard, the country's construction industry experienced a contraction of 5% in 2019 and 5.3% in real terms in 2020. However, restrictions on activity relaxed, and operations on construction sites resumed, facilitating the industry's recovery by 2021 (ibid. p. 1). The forecasted 2023-2025 period in Zambia indicates that the output from the industry is expected to receive support from the government in terms of investment in the development of energy and utilities, industrial construction projects, and transport infrastructure (https://www.reportlinker.com/p06129890/Construction-in-Zambia-Key-Trends-and-Opportunities-H1.html). Regulated by the National Council for Construction (NCC) Act No 10 of 2020, the Act seeks to provide for the promotion and

development, as well as the regulation of the construction industry in Zambia to promote economic growth and competitiveness and create sustainable employment. As observed by Adwan and AlSoufi (2016), very few scholarly studies have been conducted that specifically aim at investigating the ICT Applications in construction industries and this has resulted from a difference in research purposes, intentions, objectives, and forms of ICTs. This study nonetheless builds on empirical findings from the relatively scanty pool of knowledge available on applications of ICT in the construction industry. This is notwithstanding that the focus of this study is to determine factors affecting the adoption of ICT for project management in the construction industry in Lusaka, Zambia

2.2 Empirical Literature

Globally, the construction industry has faced criticism for its lack of efficiency and productivity (Filipe Barbosa, Jan Mischke, and Matthew Parsons, 2017). The lack of efficiency and thus, productivity has previously been attributed to the fragmented nature of project delivery (Abubakar, 2014). ICTs have been identified as essential tools for improving business processes across economic sectors including the construction industry and are catalysts for the creation of new business opportunities with the ability to integrate various processes thus reducing the data re-entry of information (Veronica Nkechi Imakwu and Babatunde Bayodele Olofin, 2016). It is for this reason and as observed by Virgo Sulakatko (2016), that the existence of ICT and its growth has changed the contractor's preferences and pushed the business processes in construction projects from the traditional way of doing things. For organizations to compete in today's competitive market, they need to become more proactive and embrace the use of information technology systems in their business processes (Elham Soltani, 2020). The important advantages of the utilization of ICTs have resulted in growth with regards to the amount of work done, better exchange and faster access to information, financial control, and fewer complexes and an increase in the quality of work while identifying unrecognized issues in various activities (Zachiang, 2017). As elaborated by Vukomanović (2012), aspects of costs, quality, and time are significant determinants of any project's success. Time scheduling, for instance, is considered among the critical factors in the construction industry (Al-fadhali, Najib and Zainal, Rozlin, 2017). Because projects have limited completion schedules, project teams ought to ensure their own deliverables are met

within the set timelines. Project's output acceptance to all intents and purposes is tight to deliverables that are cost-effective, of expected quality, and time bound. However, the transition to the adoption of ICTs from traditional paper-based requires a strong change management procedure and methods to facilitate change and prevent resistance (Sargent, 2012). At other times budget constraints have had a bearing effect over investment in ICTs and its adoption. For instance, costs associated with the recruitment of professionals as well as skilled project team members come at a cost as well as auxiliary trainings in the overall utilization of ICTs (Lekan, 2018). However, and as observed by (Mwanakatwe, 2021), applying ICT governance principles in the adoption of digital technology tools and applications should be core to decision making (ibid p. 201). Further studies concerning the adoption of digital technologies to drive business processes within organizations indicate that the innovations are efficient re-engineering methods that lead to time-management (Andipakula, 2017). This is notwithstanding those other complimentary challenges like stable power supply, malware threats, etc., continue to impact the effective potential of ICT adoption in the sector. And as identified by Khudzari (2021), a lack of digital literacy skills was another factor in the acceptance of digital technology within the construction industry in many jurisdictions, especially in the developing world. For capital-intensive sectors such as the construction industry the intervention and logistical support of government for private businesses especially SMEs involved in this sector with respect to their operations should lighten investment requirements in equipment and digital technology accessories including their adoption thereof (Isamil, 2021). In the absence of structural and financial support to particularly SMEs within capital-intensive sectors, the adoption of new technologies is adversely affected by the unfavorable economic environment (Waziri, 2017). Waziri further states that there is a need for the allocation of resources by top management to allocate resources to ICT adoption.

2.2.1 Global Perspective on the Use of ICTs for Project Management in the construction industry

Globally, the construction industry has been identified to contribute about 8–10%, on average, to the economies of different countries. This has led to the promotion of growth, provided mass job creation, and acted as a link between the economy and

other industries. The industry is a driver for growth and facilitates a flow of goods and services with various sectors. In 2017, the output of the global construction industry exceeded USD 10 trillion. In Australia in 2017, the construction industry contributed 9% of all employment and 8.1% of the country's GDP. The portion from the industry on the overall GDP in China and the UK was 5.7% and 6.5%, respectively. The sector is thought to be one of the least digitalized and has been hesitant to adapt innovation, especially when it comes to adopting digital technologies. Further, poor productivity has been seen to be a pivotal aspect of failure in the construction industry. Some evidence of change in the building industry was provided by the introduction of technologies like Building Information Modeling (BIM). The perceived risks and difficulties related to BIM's development, however, have slowed down its adoption globally. Additionally, BIM's capacity to address industry difficulties is misunderstood by individuals and organizations. Due to this, the technology has been neglected, and knowledge and comprehension of it are lacking. (Source: https://www.sciencedirect.com/science/article/abs/pii/S2352710221005842).

Studies have been conducted in various places globally on adoption of ICTs in the construction industry and project performance with respect to the construction industry (McNamara and Sepasgozar, 2021; Moshood, et al, 2020; Schönbeck, et al, 2020; and Hou, et al, 2021). These findings from research tend to focus on how ICT is utilized and the various factors that affect its execution as part of the process in construction management. Scholarly works have provided a platform to discuss the expected merits associated with the use of ICT in project management and construction. An example is the exploration of the integration of Computer Aided Design (CAD) modelling with BIM by Penttilä (2006) to produce BIM based CAD systems that were designed to shorten project spans and costs. In the same capacity, there was an investigation by Jensen and Johannesson (2013) on the application of BIM in the Nordic countries in terms of drafting techniques including BIM, and the International Finance Coalition (IFC), an industry responsible for managing the environmental and social risks of projects compliant BIM in comparison with CAD applications. Previous studies had also been conducted by Jacobsson and Linderoth (2012) over the assessment of users' overall perceptions of ICT and its impact post-adoption stage in Swedish construction companies. In other related areas, SimulEICon, an ICT tool for economic and environmental impact analysis that employs an NSGA-II as a multi-objective decision support tool for

sustainable building, was introduced by Inyim et al. (2014). A set of optimal solutions, called non-dominated, was designed by the NSGA-II to find a solution that provides a suitable concession between all objectives without considering any of them to be of little or no value. This was created as an Autodesk Revit Architecture add-on application that blends BIM with optimization methods. In addition, Wang et al. (2014) suggested a framework for a BIM-based integrated construction engineering and project management education platform (BIMIEP), which enables exchanging knowledge regarding CEPM education across the ICT tools. In this case BIMIEP for instance, allows for interoperability across different ICT tools, data sharing across projects and companies, and among different stakeholders. Adafin et al. (2021) claim that the construction industry in New Zealand has increasingly used ICT throughout the project's operational and design phases, leading to unstructured and discrete utilization techniques. However, the lowest ICT utilization levels were seen in the construction management and onsite building execution phases in New Zealand. Moreover, the New Zealand construction industry's use of ICT was most predominant during the design stage and less predominant during the project management phase. Through the use of an ICT barometer structured survey from the Finnish construction industry, Howard et al. (2008) assessed ICT usage across design and construction firms. According to the report, the majority of firms used computers primarily for managerial functions and internal administrative processes, with an inclusion of archiving. In this context, fewer organizations used ICT solutions for document sharing, cloud computing, or project management throughout delivery. Similar findings were made by Lu et al. (2019) in their empirical examination of instances from the construction industry. Basic ICT applications including spreadsheets, accountancy, word processing, and email are used widely, according to a report. According to Lu et al. (2019), there was the utilization of the modern ICT tools in larger firms compared with SMEs. In addition, just a small proportion of organizations used advanced and unconventional tools like 3D and 4D technologies.

2.2.2 Regional Perspectives on the Use of ICTs for Project Management in the construction industry

A framework for collaborating and planning with development partners and the private sector is provided by the Regional Infrastructure Development Master Plan (RIDMP), which was signed at the Southern Africa Development Commission (SADC) in August 2012. The framework also directs development in vital infrastructure such as rail, roads, and ports. The master plan with a forecasted long-term (2022-2027) is in line with Vision 2027 for SADC. Forecasting the region's infrastructure needs uses a 15-year implementation horizon. Further, the regional master plan also complies with African Union's Programme for Infrastructure Development in Africa (PIDA). This is an important contribution to the interregional infrastructure master plan, which also proposes a triangular Free Trade Area between SADC, COMESA, and the East African Community (EAC). By meeting infrastructure needs by 2017, the SADC region is starting the fundamental work of establishing an enabling environment. This is done in accordance with the SADC Infrastructure Vision 2027 aimed at enabling the realization of regional socio-economic integration and sustainable development. (Source: https://www.sadc.int/pillars/infrastructure-development-support-regional-integration). SADC adopted the RIDMP at the backdrop of the region's huge infrastructure deficit across sectors such as energy and water supply; reticulation and sanitation systems; inadequate and expensive broadband networks, etc. The RIDMP thus, seeks to address infrastructure deficit within targeted development sectors including ICTs (SADC Regional Infrastructure Development, 2019 p. 9). Among the identified opportunities and challenges is the promotion of the utilization of the Virtual Information System designed for reporting regional projects in real time. In this regard, SADC enforced a virtual Information System with a view to improving the monitoring and evaluation process for infrastructure projects, unfortunately, there is no utilization of this system (ibid p. 14). The report recommended that Member States work towards making use of this platform for the purpose of providing reports periodically and communicating concerns related to ongoing regional projects (ibid p. 14). A research study conducted in South Africa to assess the benefits of using ICT tools by construction organizations in South Africa (Tanga, et al, 2021) revealed that time savings, competitive advantage, and good communication management were

advantages of using ICT tools. Findings from a study conducted in Nigeria by Rasaq Olaniyan (2019) concerning the adoption of ICTs in the construction industry indicated that the adoption of ICT was influenced by culture, policy, and cost with culture playing a major role. The lack of skills by project managers has made the adoption of ICTs even more difficult. Further, construction activities suffer from time delays, which have been attributed to the lack of skills among workers to adopt ICTs as well as the experienced managers who have been in the industry for some time but have limited ICT skills (Sahamir, 2021). The recommendations from this study suggest that the adoption of ICTs needs to be exercised with maximum care.

2.2.3 Local perspective on the use of ICTs for Project Management in the construction industry

The construction industry in Zambia is superintended by the National Construction Council (NCC) a statutory body established through an Act of parliament. Also referred to as the NCC Act No. 10 of 2020, it aims to foster economic growth, competitiveness, and sustainable employment by promoting the development and regulation of the construction industry in Zambia. Generally, the construction industry has been described in terms of the demand and supply of construction services (Cheelo and Liebenthal, 2020). The ease of exit and entry, the size of consumers and suppliers, the pricing procedures, and the level of information flow is the way the industry is organized (ibid p. 403). On the supply side, the NCC had a record of 3,081 registered enterprises in 2016, according to a report by the NCC and Zambia Institute for Policy Analysis and Research (NCC and ZIPAR 2017). According to the NCC list of registered contractors (NCC 2018), this scaled by 7/10 as of September 30, 2017, to reach 3,791. NCC and ZIPAR (2017) provided an estimation that 91.4 percent of the firms in the construction industry were owned by Zambians, firms owned by foreigners stood at 4.4 percent only, and firms jointly owned held 4.2 percent in terms of ownership. Despite making up less than 5% of the industry, foreign-owned companies tend to dominate it, winning the majority of the contracts. For example, in 2014, 90 percent of construction firms owned by foreigners that made submissions of their public bids for tenders were successful and had them secured, as opposed to the 3.8 percent of firms owned by Zambians that were successful in the same year (ibid p. 404).

The Seventh National Development Plan (7NDP) 2017-2021 provides information on ambitions relating to public infrastructure development. One of the ten Strategic Development Outcomes of the 7NDP, titled "Improved Transportation Systems and Infrastructure," is included. The primary focus of infrastructure development is on the building and restoration of railways, road systems, and inland and coastal waterways. Further areas of focus include the expansion of aviation operations and infrastructure. Additionally, the Development Outcomes for information and communication technology (ICT), tourism, water and sanitation, agriculture, and other fields all include elements of linked infrastructure development (7NDP; Republic of Zambia 2017). Specific data sources related to the adoption of ICTs in the construction industry in Zambia is scanty. However, the study conducted by Mwape and Ndihokubwayo (2010) on ICT uptake and utilization in Zambian construction industry revealed that Zambia has not completely understood the importance of ICT and how its utilization affects production and value chain management. The study further revealed that delays in the adoption of ICT in Zambia is preventing improvements in building quality, cost-effectiveness, and local business's ability to compete.

An increase in the engagement of private trainers to participate in credentialing and ICT training, lobbying for increased government funding for training programs, participating in sharing of information at a regional level on procedures for competitive bidding and long-term programs for the development of local contractors, and more were suggested as interventions to improve the ICT adoption in the industry. A study by Philemon Daka (2016) on the Impact of Adoption and Usage of Information and Communication Technologies (ICTs) in Selected Manufacturing and Business Firms in Zambia revealed an increase in the use of ICTs particularly computers, and internet. The study further indicates the need for an accelerated adoption of ICTs. A study by Martin Mwila (2019) on the use of ICT by SMEs in Zambia to access business information services and investment barriers and drivers. The study suggested that costs associated with the procurement of ICTs, and network infrastructure prevented the adoption. In addition, the unavailability of electricity in areas where ICTs could be utilized affected the adoption. The report highlighted the need for the interventions by the Government in line with policies directed towards improving accessibility of ICTs.

2.2.4 Knowledge Gap Analysis

Table 2.1 presents a summary of the research's key findings from the literature review, along with a gap analysis.

Table 2. 1 Knowledge Gap Analysis

AUTHOR AND YEAR	TITLE	FINDINGS	GAP ANALYSIS
Rasaq Olaniyan., et al (2019).	Barriers to Technology Adoption Among Construction Project Managers in Nigeria.	The adoption of ICT is influenced by culture, policy, and cost with culture playing a major role.	The study focused only on Construction Managers and the adoption of ICTs. It does not explicitly include other relevant stakeholders in the value chain.
Sargent., et al (2012)	Factors influencing the adoption of information technology in a construction business	The transition to the adoption of ICTs from traditional paper-based requires a strong change management procedure and methods to facilitate change and prevent resistance.	The Literature does not provide the extent at which ICTs are utilized at each stage or an analysis of the extent of the adoption of ICTs during the lifespan of a project.
Shaza Rina Sahamir et al., 2021)	Barriers Impeding the Adoption of Information and Communication Technology (ICT) in Construction Project Management	construction activities suffer from time delays, which have been attributed to the lack of skills among workers to adopt ICTs as well as the experienced managers who have been in the industry for some time but have	Results from the study only provide for computers and email as widely used tools in managing construction projects. This is not exhaustive considering the diverse ICTs involved in construction project management.

	(Malaysia)	limited ICT skills	Research is Limited to Barriers and does not provide interventions to be put in place to enhance adoption of ICTs.
Mwape and Ndihokubwayo (2010)	ICT uptake and utilization in Zambian construction industry	Zambia has not completely understood the importance of ICT and how its utilization affects production and value chain management. Delays in the adoption of ICT in Zambia is preventing improvements in building quality, cost-effectiveness, and local business's ability to compete.	The study was Limited to e-mail services, interactive websites and short messaging services (SMS). Other aspects of ICTs were not considered to clearly identify the extent of the factors affecting ICT uptake of ICTs.
Philemon Daka (2016)	Impact of Adoption and Usage of Information and Communication Technologies (ICTs) in Selected Manufacturing and Business Firms in Zambia	The study indicates the benefits of using ICTs which include the increased productivity which ultimately leads to high profit margins as a result of adopting ICTs in business processes.	The research focused more on tools i.e., computers and internet and their impact on business processes. The study did not provide an input from the target group on how to adopt existing technologies into business processes.

Martin Mwila (2019)	The use of ICT by SMEs in Zambia to access business information services and investment barriers and drives	Costs associate with the procurement of ICTs, the absence of network infrastructure and security were major barriers to the adoption of ICTs.	This research focused on external interventions on barriers affecting the adoption of ICTS i.e., poor network, cost, and infrastructure with little focus on the people process which play a role on the adoption of ICTs. The study encompasses Construction industry among other SMEs but does not narrow down to factors affecting the adoption of ICTs for project management in the construction industry as a segment.

2.3 Theoretical Framework

2.3.1 Grounded theory

A research technique called grounded theory deals with the creation of theory (Glaser and Strauss, 1967) which is 'grounded' in data that has been carefully gathered and examined (Strauss and Corbin, 1994). It is used to learn about things like group behaviors, sometimes referred to as social processes, and interpersonal connections (Crooks, 2001). It was created by Glaser and Strauss in California, USA, as part of their research on "Awareness of Dying" (Glaser and Strauss, 1967). It is a methodology generally used for developing a theory that is grounded in data that is systematically gathered and analyzed. The theory presumes that when carrying out a grounded theory study the area of interest is first identified. Although it is acknowledged that this has challenges in practice, the elimination of theoretical prejudices is imperative. After employing analytical techniques and sampling techniques, the investigation is completed when theoretical sampling is attained (Dey, 1990). It is possible to collect quantitative, qualitative, or a mix of the two forms

of data. Widely used data collection methods include Open-ended, in-depth interviews. As new hypotheses emerge, the answers to questions may change. other available options include Focus groups and observational methods. A theory that is based on the researcher's data will be created by applying grounded theory and adhering to it as a research methodology (Strauss and Corbin, 1998).

2.3.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) describes how individuals accept information systems by individuals. TAM makes the underlying assumption that users' behavioral intentions, in turn, are influenced by their perceptions on the use of a given technology in carrying out the task and its perceived simplicity of use (Marikyan and Papagiannidis, 2022; Technology Acceptance Model: A review). TAM's primary goal was to provide an in-depth review of triggers relating to technology adoption in order to forecast behavior. This, in turn, would assist offering a theoretical justification for its successful use. The useful objective of TAM was to inform practitioners about potential pre-implementation steps to consider before the implementation of systems (ibid., p. 2). Several septs were done to implement theory's objectives (Davis, 1989; Davis, 1993). By specifying the procedures that facilitate the correlation between information system features (external factors) and definite system use, Davis built the model of technology acceptance. A psychological viewpoint on human conduct was provided by the Theory of Reasoned Action that was lacking at the time in the literature on information systems and served as the model's foundation (Davis, 1989; Davis, 1993).

The TAM theory second stage involved picking variables, describing them, and validating measurements that would be highly correlated with system usage (Marikyan and Papagiannidis, 2022). Founded on former empirical literature on the management of information systems and human behavior, multi-item scales for perceived usefulness and perceived ease of use were built, pre-tested, and validated in various studies (ibid p. 2). It was hypothesized that the two concepts were essential elements when it comes to user acceptance, based on evidence from earlier studies research (Johnson and Payne, 1985; Payne, 1982; Robey, 1979). According to the research, the choice an individual makes to engage in a behavior is

the consequence of an evaluation of the value they anticipate from the conduct relative to the effort and/or cost they will need to engage in it. (Johnson and Payne, 1985; Payne, 1982). This entails that an evaluation of the trade-off between what a system is perceived to provide in terms of its use and its functionality, and its perceived ease of use will determine how the information system is utilized (Davis, 1989). The meaning of perceived usefulness was assumed to be individual's estimation of the degree to which using a particular technology will enhance their performance (Marikyan and Papagiannidis, 2022). This construct was conceptualized as a consequence of Bandura's outcome judgment idea, which implies an individual's anticipation of triggering behavior resulting from a positive outcome (Bandura, 1982). Stemming from information proving the impact of system performance expectancy on system utilization, perceived usefulness was operationalized (Robey, 1979). Perceived ease of use was identified as the level to which somebody thinks about the difficulty in the use of a particular system (Davis, 1989). This term derives from the idea on one's ability to carry out actions for the prospective task i.e., self-efficacy (Davis, 1989; Bandura, 1982).

2.3.3 Roger's Diffusion of innovation theory

Developed by Rogers in 1962, the diffusion of innovation theory explains how people adopt new technologies as well as their behavior towards a product. Rogers' diffusion of innovations theory is appropriate for investigating the adoption of technology across sectors (Medlin, 2001; Parisot, 1995). In fact, a lot of diffusion study incorporates technological advancements; therefore Rogers (2003) usually used the word "technology" and "innovation" interchangeably (Sahin, 2006). Rogers asserts that "a technology is a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (ibid p. 13). Software and Hardware make up the two components. According to Rogers (2003, p. 259), Software is "the information base for the tool", while the hardware is "the tool that embodies the technology in the form of a material or physical object." Software adoption is rather slow-moving because it is a technological breakthrough with a low level of visibility. For Rogers (2003), adoption is a choice of "full use of an innovation as the best course of action available" and rejection is a choice "not to adopt an innovation" (p. 177). Diffusion is defined by

Rogers as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). The four essential elements of the diffusion of innovations are innovation, communication routes, time, and social system, as stated in this definition (Sahin, 2006).

2.3.4 Ajzen’s Theory of Planned Behavior

The theory of reasoned action led way for the theory of planned behavior (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975), which was necessary to address activities over which people have limited free will (Ajzen, 1991). An individual's intention to engage into a particular action is a fundamental component of the idea of planned behavior (ibid., p. 4). It is considered that intentions reflect the driving forces behind e behavior; they serve as a measure of how much people intend to put out in terms of effort or how hard they are willing to attempt to carry out the action (ibid p. 4). Typically, an activity should be more likely to be carried out if it is planned to be carried out with more intent. However, it should be recognized that only when a behavior results from one’s own will can a behavioral intention be expressed in action (ibid p. 5). The performance of utmost behaviors relies, as a minimum in part, on non-motivating factors as the availability of necessary opportunities and resources, e.g., money, time, collaboration of others, and skills, even if certain activities may, in fact, meet this criterion fairly well (Ajzen, 1985). All of these components together show how much control individuals actually have over their behavior. A person should succeed provided that the required resources and prospects are available, and that person intends to perform.

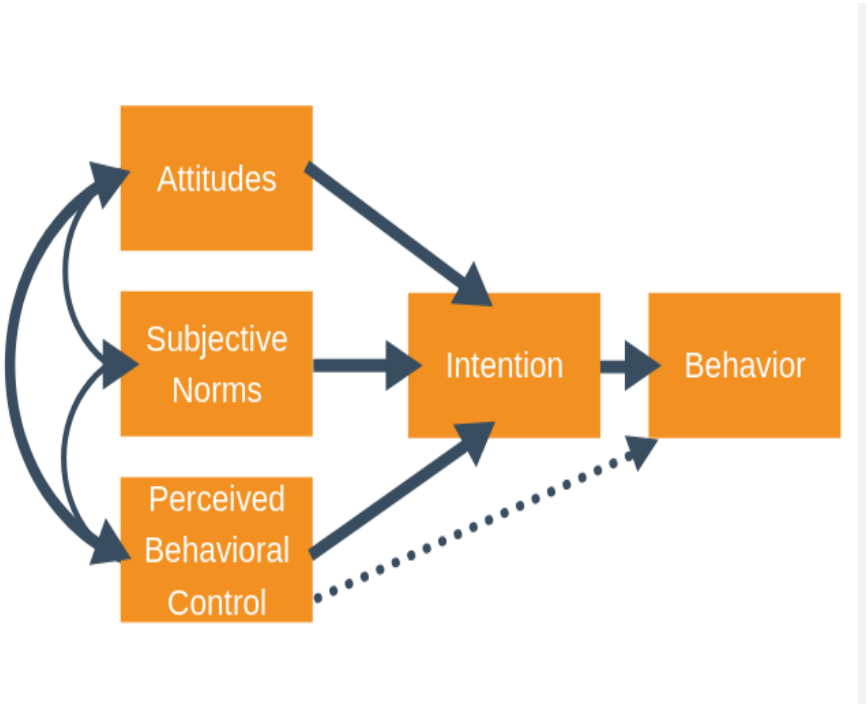

Figure 2. 1 Theory of planned behavior (Source: Acek Ajzen, 1991)

2.3.5 Summary of Theoretical Framework

The grounded theory helped in this research as it provided a systematic approach towards understanding the factors affecting the adoption of ICTs for project management in the construction industry. Using this research methodology, which conforms to specific methods for data analysis, the unseen social and collective patterns, and constructs in the construction industry could be found and conceived by researcher. Further, this method allowed for theories to emerge from the empirical data collected thereby provided for contextual understanding based on the results collected. furthermore, this theory provided valuable insights for the researcher and the practitioners who will seek to enhance the use of ICTs in construction projects.

The TAM assisted the researcher in providing an understanding and prediction of user's acceptance and the adoption of technology. Further, it provided for a practical approach towards the development of strategies to facilitate the adoption of ICTs and promote their use effectively. It was beneficial in exploring the adoption towards ICTs in relation to the awareness against the utilization of ICTs on project management in the construction industry. This provided for the relationship between the perceived ease of use and perceived usefulness in ICTs across the different

players in the industry. By exploring these factors, the researcher was able to also understand the extent in which ICTs were being adopted as well as the challenges related to the adoption of ICTs as they influenced its adoption. The theory was further applicable in exploring different variables such as social influence and facilitating conditions such as management support, organizational culture, training resources and industry norms. The theory, furthermore, helped the researcher as it provided a theoretical basis for predicting individuals' adoption behavior based on the intentions users had to use a given technology.

Rodger's diffusion of innovation theory assisted the researcher in understanding the different groups of adopters i.e. these groups include innovators, early adopters, early majority, late majority, and laggards. These were provided for understanding the complexities associated with adopting ICTSs. Understanding the various groups provided the dynamics associated with the factors surrounding the adoption of ICTs as well as the extent in the adoption of ICs in line with the development of strategies to ensure the effective adoption.

Azens theory of planned behavior was useful in examining the subjective norms, attitudes and attitudes from players in the construction industry towards the adoption of ICTs. The theory provided for an insight into the psychological and social determinants associated with ICTs. This assisted in formulating the strategies to promote the successful adoption of ICTs within the construction industry. The theory provided for understanding the perceived behavioral control, the attitudes of construction professionals and their beliefs about the benefits and the drawbacks towards the adoption. It also led the research towards the influence of subjective norms by understating the opinions of various groups such as the architects, clients, suppliers, civil engineers, consultants, and project management officers regarding the adoption of ICTs. This theory helped in providing targeted interventions to address barriers, and increase perceived behavioral control over the adoption process.

2.4 Conceptual framework

A conceptual framework is a diagram that illustrates the connections between the concepts under study. Researchers can use conceptual frameworks to assist them explain their ideas to others and to help them think more clearly about the research subject.

The researcher reviewed empirical literature and gained a comprehensive understanding of the current research topic. The theoretical literature provided a foundation on information on factors affecting the adoption of ICTs and the conceptual framework was used to visualize and clarify the research problem as well as the relationship between different variables. The adoption of ICTs is determined by Technology, Process and People. These were identified as the independent variables. these variables The Identification of independent and depended on variables guided the researcher in developing a questionnaire.

The adoption of ICTs in relation to Technology can be affected by the cost associated with the procurement of ICTs, the complexity of the software application, its perceived usefulness, reliability and security. The process relates to the time required to adopt a given ICT, change management procedures and interventions towards the achieving the desired outcome in the use of a given ICT, the cost associated with deployment and the standards associated with the company norms and standard operating procedures, and Policy regarding a given ICT. The People relates to the end users of a given ICT, there awareness and utilization on ICTs, the leadership and top management support on the adoption of ICTs, and the attitude towards the adoption of ICTs.

The conceptual framework focuses the study's scope by concentrating on the identified variables, i.e., technology, process, and people allowing for a targeted and thorough analysis on the adoption of ICTs for project management in the construction industry and its project management. Figure 2.2 shows the Theoretical Model of Factors Influencing IT Adoption. By addressing these factors holistically and proactively, organizations can enhance their readiness for ICT adoption and increase the likelihood of successful outcomes in the construction industry.

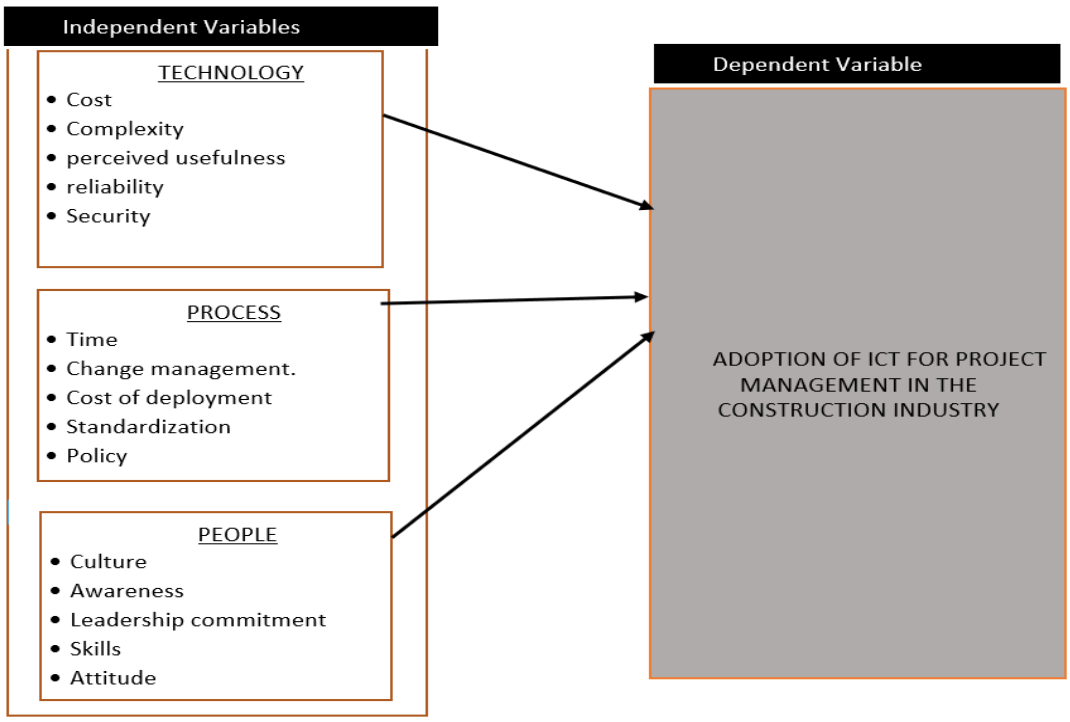

Figure 2. 2 A Theoretical Model of Factors Influencing IT Adoption by A. Y. Waziri, Y. Mustapha, and K M. Idris, 2017, International Journal of Engineering and Technology, 9, p. 1813

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter discusses the research approach, research design, study population, sample size, data collection, and methods of analysis that will be used during the research.

The research methodology was qualitative in nature, using a X approach. The study focused on Individuals and institutions involved on projects in the construction industry in Lusaka, and explored the factors that affect the adoption of ICTs in the construction Industry.

The data for the study was collected through survey questionnaire with key informants such as consultants, project management officers, architects, civil engineers, and quantity surveyors representing different institutions. The results of the data will be analyzed using thematic analysis.

3.2 Research Approach

A Research Methodology refers to the overall framework or guiding principles that will direct a study (Dawson, 2002). Research can be done in a variety of ways (Yin, 2003; Creswell 2007; Dawson, 2002). According to Yin, the primary methods applied on doing research include experiments, histories, case study, surveys, and the analysis of archived data (Yin, 2003). Yin goes a step further to differentiate these tactics from one another and that each may have their advantages and disadvantages when applied depending on three conditions which are; control over behavioral events that the researcher has, the focus on contemporary instead of historical phenomena, and type of research question (Yin,2003). A mixed-method approach was used in the study, which was a combination of both qualitative and quantitative methods. This provided obtaining a deeper understanding of the factors affecting the adoption of ICT for project management in the construction industry. To address the aim of the study, research questions employed to guide the study were the following:

i. What are the factors that affect the adoption of ICT in project management in the construction industry?

ii. Why does the construction industry have challenges adopting use of ICTs for its own projects management?
iii. How can the construction industry be incentivized to adopt use of ICTs for project management in its own industry?

The mixed methods approach provided for an analysis of the factors affecting the adoption of ICTs for project management based on the respondents experience as well as an understanding and a provision to consider on how, and what, strategies could be enforced to enhance the adoption of ICTs.

3.3 Research Design

The concept, structure, and strategy of an inquiry intended to gain answers to research questions and control variance, according to Kerlinger (1986), constitutes a research design. The research design was survey research. This provided an understanding of the respondent's behavior as they responded to the questions. Online surveys were used in this study. This method enabled the researcher to reach out to a wider number of individuals in institutions and enabled respondents to provide feedback at their comfort. Descriptive statistics were provided about the individuals with regard to their role on projects and their area of specialization in the construction industry. Further, A Parallel convergent mixed method design was used in this research.

3.4 Study Population

The term "population" refers to the collection of all the units to whom the research conclusions should be applied. Target population had been the project management practitioners in the construction industry who were, and were not, utilizing ICT in their projects.

Table 3. 1 Distribution of respondents according to roles and positions

No.	Area of specialization	Number	%
1.	Civil Engineer	9	30.0
2.	Architect	5	16.6
3.	Project Management Officers	6	20.0
4.	Quantity Surveyor	2	6.7

5.	Consultant	2	6.7
6.	Suppliers	3	10.0
7.	Client	3	10.0

3.5 Sample Size

The procedure of choosing a subgroup of individuals from a population to make an estimate of the characteristics of the whole population is referred to as sampling (Singh & Ajay, 2014). A sample size is a portion of the population from which the researcher hopes to draw general conclusions about the findings. Any claims made about the sample must also apply to the entire population (Sharon Njahira Thinguri & Dr. Allan Kihara, 2017). Participants were chosen from a variety of positions and backgrounds in order to produce a rich data set that would allow for the collection and analysis of a varied sample of replies in order to aid in decision-making. The target population was 30 individuals from various institutions in different areas of specializations, and the following formula was used to get the sample size. Slovins formula was used to derive the appropriate sample size.

$$n=N/1+N(e)\text{^}2$$

$$n =30/\ 1+30(0.03)\text{^}2$$

$$n=30/1+30\ \ (0.0009)$$

$$n=30/1+0.0027$$

$$n= 30/1.0027$$

$$n= 29.92$$

$$n=30$$

n is the sample size

N is the total population

E is marginal error

With a 97% level of significance

3.6 Sampling Technique

The researcher used the judgmental/purposive sampling technique as this targeted people in the construction industry involved in projects both directly and indirectly i.e., architects, civil engineers, project managers, project officers, clients, and consultants. This technique was used to pick individuals who had the skills and background needed to meet the goals of the study. The method of purposive sampling made sure that the chosen individuals could offer insightful commentary on the elements influencing the adoption of ICTs for project management in the construction industry.

3.7 Data Collection/Instruments

These target groups included representatives from selected different areas of specialization in the construction industry including project managers and project management officers, architects, and civil engineers, consultants, and IT specialists. Google Drive platform was utilized to hold the collected data and to make it obvious to all parties. The researcher used a survey approach with the target population to collect research data to satisfy the purpose of the research. Online questionnaires were also used, and surveys were created using Google Forms.

3.8 Primary data

Primary data is referred to data that is collected firsthand (Uma Sekaran & Roger Bougie, 2016). The methods of data collection with reference to primary data include observations, administration of questionnaires, interviews, and experiments. For this study, the researcher administered standard questionnaires for the purpose of collecting primary data as well as to conduct the survey. The questionnaires were administered via Google forms platform.

3.9 Secondary data

Data that already exists and does not need to be collected by the researcher can be categorized as Secondary data. Statistical bulletins, publications by the government, published or unpublished information from organizations, business websites, and the Internet are among examples of secondary sources of data (Uma Sekaran & Roger Bougie, 2016). The researcher collected secondary data from Statistical bulletins,

publications by the government, published or unpublished information from organizations, business websites, and the Internet with a focus on the factors affecting the adoption of ICTs and the corresponding measures put in place towards the adoption of ICTs. The researcher reviewed publications from universities to also establish the extent of existing literature on the rate of the adoption of ICTs as well as the coverage to determine the technologies explored and the methodology used to determine the quality of data collected.

3.10 Research Instruments.

The research objectives guided the design of the questionnaires, which included questions about factors affecting the adoption of ICTs for project management in the construction industry. Semi-structured interviews were used as a qualitative research tool to get insightful data from individuals who had been nominated. Open-ended questions during the interviews gave participants the chance to share their opinions on measures to be put in place to enhance the adoption of ICTs for project management in the construction industry These also offered an in-depth analysis of the response in line with the research aim. Closed ended questions were also administered to the target group. The use of closed-ended questioned was to offer control over the response questions and given the diversity of ICTs, it was pertinent in the analysis of the result set in line with the objectives of the study. A deductive approach was employed to determine preconceived ideas during analysis.

3.11 Data Analysis

The course of inspecting, validating, sorting, and testing the collected data to obtain a meaningful result of the research is referred to as Data analysis (Yin, 2003). One of the approaches for analysis is relying on the theoretical proposition of the research reflecting the research. This strategy facilitates the organization of the entire research and can recommend different alternative justifications which can be investigated. The setting up of a framework in relation with opposing explanation, is a pertinent strategy even in absence of a theoretical proposition is another strategy that can be used. It tries to explain the why certain outcomes exist that are not consistent with prior theories. Developing case descriptions is the last strategy; however, it is used in cases where the previously mentioned tactics prove to be challenging to apply to research (Yin, 2003).

This analysis of data in a mixed methods approach consists of three phases (John W. Cresswell and David Creswell, 2018). First, the qualitative database was analyzed into broad themes. The quantitative data was analyzed according to statistical results. The mixed methods data analysis was used last, and it is in this phase that the two databases were integrated. A side-by-side comparison approach was used to merge the two databases and provided in the discussions. The quantitative statistical results were first reported then a discussion was followed by the qualitative findings to confirm the statistical results. The use of a mixed-method approach to this research allowed for the provision of adding more detail when drawing a conclusion in line with the factors affecting the adoption of ICT for project management in the construction industry and the provision of appropriate strategies provided by the respondents to enhance the adoption of ICTs.

In this study, quantitative data was used with a focus on independent variables i.e., Technology, Processes, and People. These variables provided insight into the factors that affect the adoption of ICT for project management in construction. The type of qualitative data collected explored the factors affecting the adoption of ICTs for project management practitioners in the construction industry. The reason for collecting both quantitative and qualitative data was to provide an in-depth understanding of not only the factors affecting the adoption but also how these factors affected the adoption within the industry. The collection of quantitative and qualitative data further provided appropriate strategies for the adoption of ICT for project management. Qualitative data was analyzed from responses from open-ended questionnaires whereas quantitative data was analyzed from closed-ended responses resulting from the survey. Figure 1.0 shows the approach to convergent parallel design approach to the study.

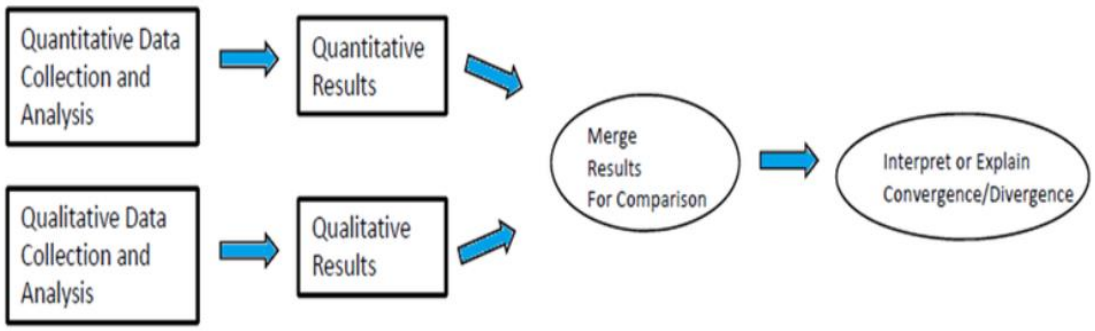

Figure 3. 1 Convergent parallel design: Creswell and Plano Clark (2017)

Collecting and processing of Data

The collection and analysis of data followed Jennifer C. Greene, Valerie J. Caracelli, and Wendy F. Graham (1989) approach to mixed methods. The approach followed triangulation which involves the utilization of both qualitative and quantitative techniques; results were collected in parallel for clarification. Research questions were designed to suit the mixed methods approach i.e., a survey was conducted with open-ended questions with regards to the qualitative method and closed-ended questions were administered in line with quantitative questions. Research questions were developed based on the research problem. The results were compared, and an interpretation was drawn based on the results from the utilization of both methods. The collection and processing of data followed a parallel convergent approach where qualitative and quantitative data was collected in parallel, the data was compared, and interpreted to draw a conclusion. The convergent design is relevant as it provided a comprehensive understanding from two databases as well as corroborate results from different methods. Both methods further provided data for equal values for understanding the research problem. Techniques that employ the mixed-methods approach include combining the two data sets, making connections between the analysis of one set of data with the other, incorporating one type of data within a larger design, and finally binding the datasets to draw conclusions. In contrast to the qualitative methodology, which provide an intriguing human element to the research in line with the factors affecting the adoption of ICTs for project management in the construction industry, the quantitative approach provided conclusive facts and numbers in line with the study.

The researcher used available existing applications to analyze and interpret the data. Microsoft Excel, google documents, and google charts were used to aid in the data

analysis. Survey questionnaires were used to collect data while adhering to descriptive content analysis. This was done to summarize the information collected from the responses to the research questions stated earlier.

3.12 Ethical Considerations

The research was be based on the factors affecting the adoption of ICTs for project management in the construction industry and it did not bring any harm or risk to the selected participants. Written consent was provided to the participants who chose to participate, and all information related to the research project. Further, the participants were at liberty to withdraw from the research at any time. Interviews were conducted at the place of convenience of the participants and Personal information was not distributed or collected during the survey.

All data collected was in connection to the research project and the common work environments of the institutions. The platform used to administer the questionnaire, i.e., google forms for surveys, ensures data confidentially, data encryption algorithms, data access controls to enable only the owner of the form to access the results, a provision to enable the respondents hide their identification, and a provision for anonymous responses. To protect the rights and well-being of the participants, the research complied with ethical standards and guidelines.

CHAPTER FOUR
ANALYSIS AND PRESENTATION OF DATA

4.1 Introduction

This research study was designed to collect data on the factors affecting the adoption of ICT for project management in the construction industry. In relation to the research objectives presented in Chapter One, this chapter discusses the results that were collected for this research. The data was collected electronically via the use of google forms platform. The table 4.1 presents how the research objectives were addressed with the data collected.

Table 4. 1 Research Objectives and how the objective was achieved

RESEARCH SPECIFIC OBJECTIVES	HOW THE OBJECTIVE WAS ADDRESSED
To identify factors affecting the adoption of ICT in project management for construction projects in Lusaka.	Identify factors that contribute to utilization of ICTs in the construction industry. Review which factors are major contributors to the use of ICTs for project management in the construction industry.
To analyse the extent the identified factors affect project performance in the construction industry;	Level of Knowledge in existing ICTs Level of usage of existing ICTs in project management in the construction industry

To recommend appropriate strategies for the adoption of ICTs for project management in the construction industry	Propose strategies to implement to promote usage of ICTs for project management in the construction Industry

4.2 Response Rate

The study focused on 35 project management practitioners in the construction industry. Thirty (30) of the 35 questionnaires were completed by the responders. As (Barbbie, 2008) indicated, a response rate of more than 50% is adequate for research analysis. Based on the response rate, this resulted in 85.7%, which was considered sufficient.

4.3 Respondents background information

Respondents were informed on confidentiality of the information and that only information related to the study was going to be collected. Respondents were asked about their gender, position and roles in construction industry and projects, their age, and some questions on the adoption of ICTs for project management in the construction industry and finally how the construction industry can be incentivized on the adoption of ICTs for project management. All the respondents were based in Lusaka District.

4.4 Respondents gender

The questionnaire administered via google forms platform received 76.7% of the respondents as male and 23.3% of the respondents being female. Figure 4.1 indicates the distribution of the respondents by gender.

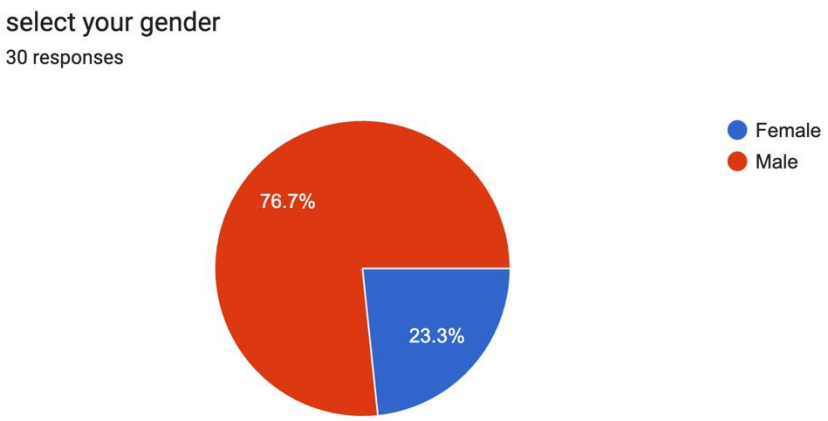

Figure 4. 1 Respondents gender

4.5 Respondents Role/Position

The research study had a particular interest in the various roles and positions that are involved in the delivery of projects in the construction industry. The respondents were asked to select the role they played and 33% of the respondents were Civil Engineers, followed by 17% who were Architects representing 17%. Project managers represented 13% of the distribution. Other roles illustrated in figure 4.2 included Consultants, ICT advisors, Quantity surveyors, Project officers, clients, and project managers.

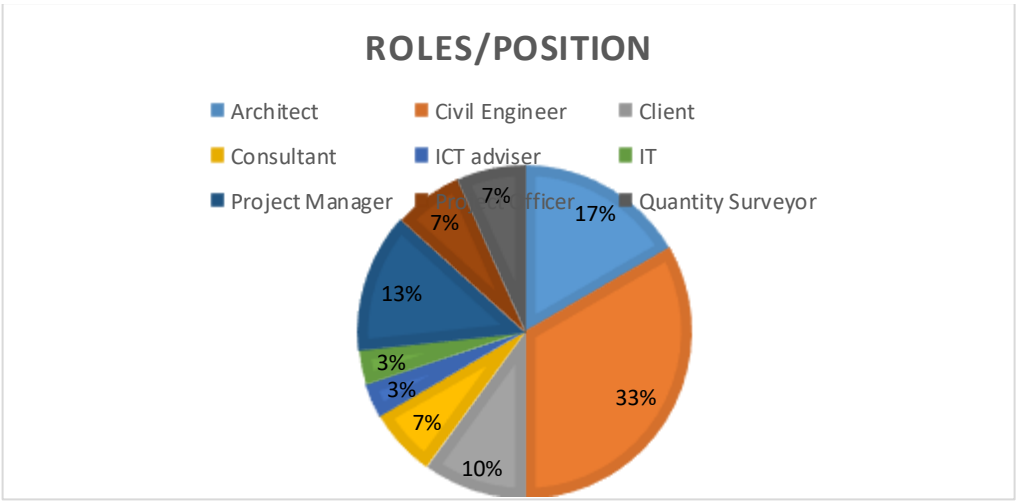

Figure 4. 2 Respondents Role/Position

4.6 Respondents Age

Given the baring that age may have on adoption of ICTs in various sectors and the adoption of ICT for project management, respondents were requested to provide the age group they belonged to. From the results, many of the respondents i.e., 70% were between 26 and 35 years old. 20% of the respondents were between 36 and 45 years old and 7% were between 46 and 55 years of age. 3% were below 26 years old as indicated in the figure 4.3.

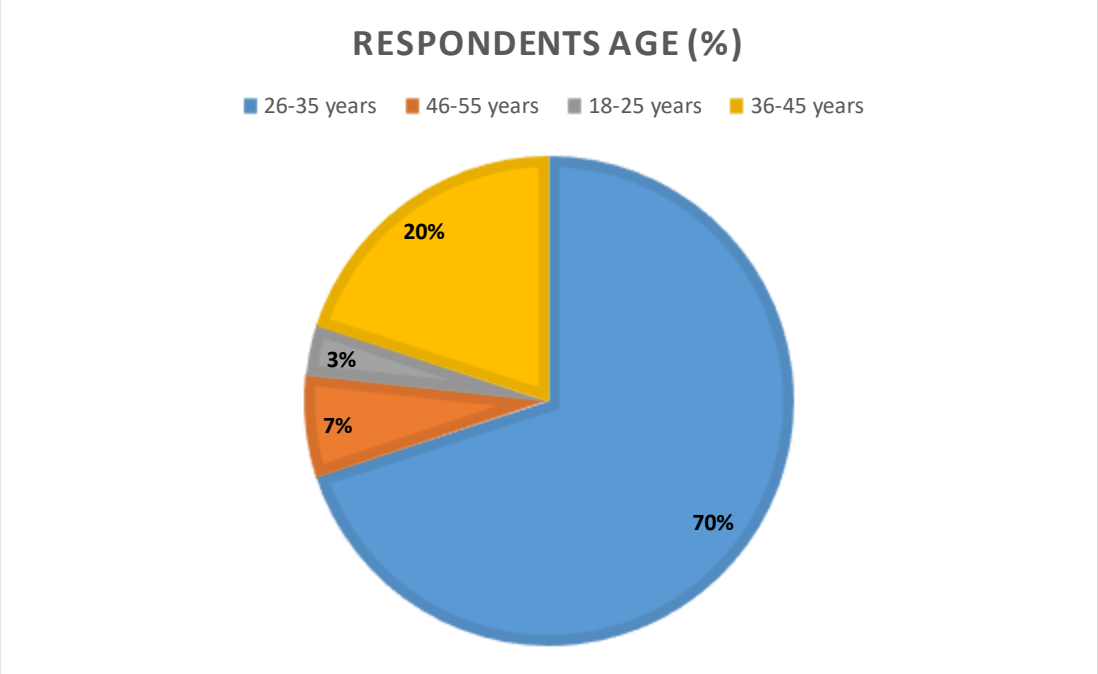

Figure 4. 3 Respondents Age

4.7 Respondents Highest Qualification obtained.

Respondents were requested to provide their highest qualification obtained. The 73% had acquired a bachelor's degree. This was seconded by 17% representation of the distribution with 17% having gone further to obtain a master's degree and 3% having PhD. Diploma holders had a 7% distribution. The figure 4.4 indicates the distribution by qualification.

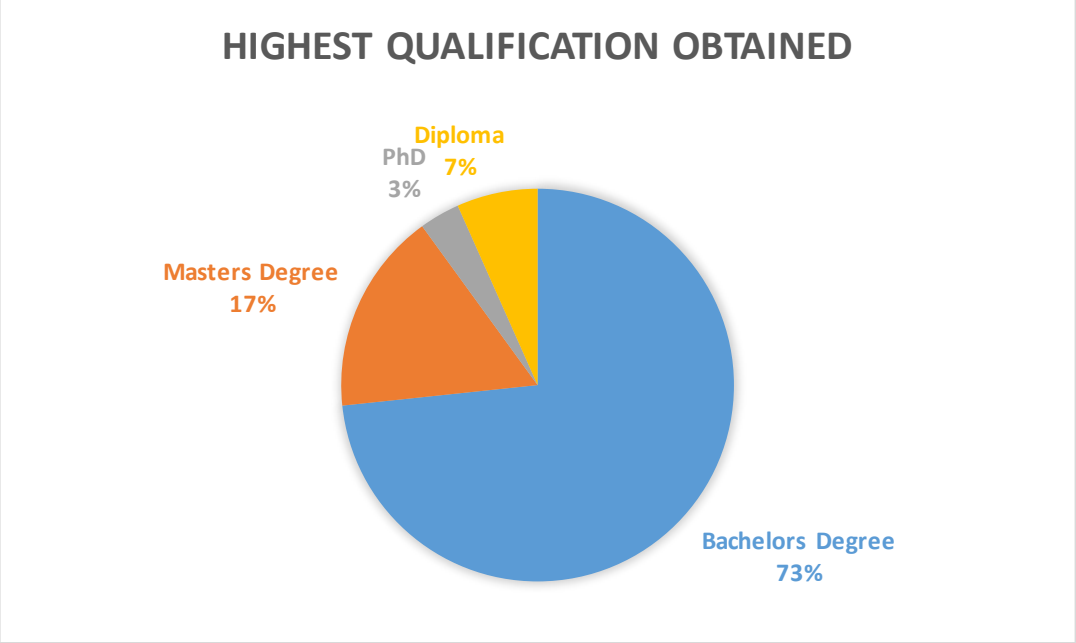

Figure 4. 4 Respondents Highest qualification obtained

4.8 Respondents were asked to describe their skillset in line with their utilization of ICT in their role in project management.

Among the respondents, 43.3% of the described their skills in ICT to be good. 26.7% described their skills to be very good and 30% described them to be fair.

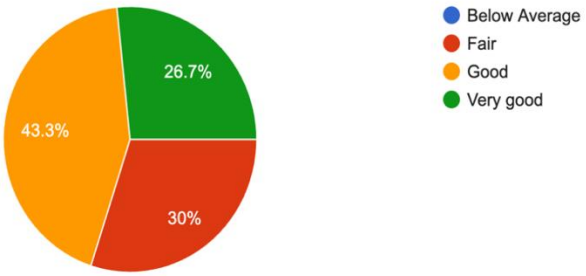

Figure 4. 5 Respondents skillset in line with utilization of ICT in project management

4.9 Experience in the utilization of ICT in project management

Given the description of the skillset, the respondents were further requested to provide their experience in the utilization of ICTs in the management of projects. 43.3% of them indicated that they had between 6 years and 10 years of experience in the use of ICTs and the same distribution indicated that they had less than 5

years' experience. 3.3% had more than 15years experience and 10% had 11 to 15 years of experience in the utilization of ICTs. This is shown in figure 4.6.

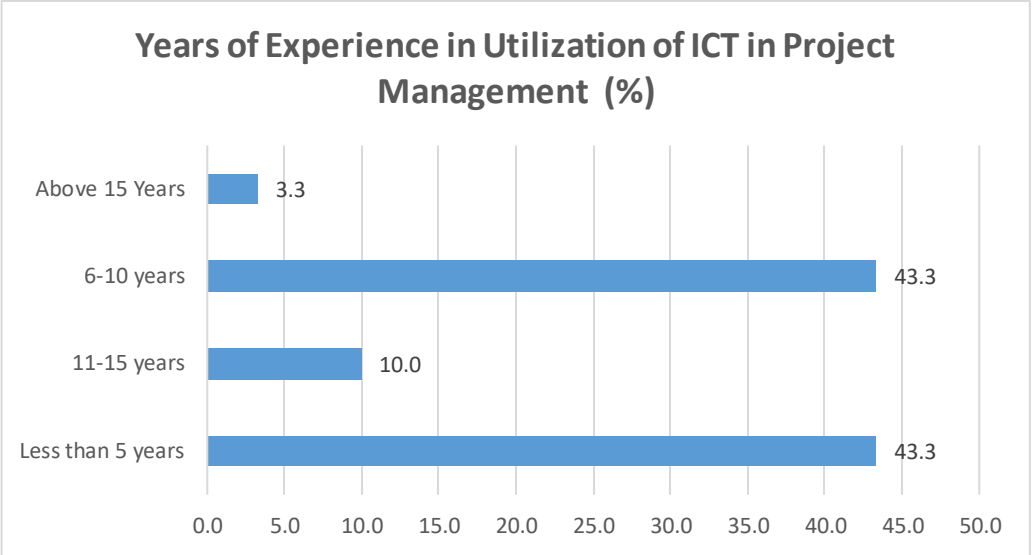

Figure 4. 6 Respondents experience in the utilization of ICT in project management

4.10 Measures put in place by organization in the adoption of ICT for project management.

The respondents were asked what measures their organizations put in place in promoting the adoption of ICTs for project management. 13 (43%) of the respondents indicated the use of capacity building programs on new and existing technologies. This was followed by verification and validation that functionality of new and existing technologies in meeting project objectives and providing efficiency and ease of use in making wok easier. Top management support and trust in new technologies was the least agreed option among the measures put in place with only 7 of the respondents, representing 23%, having accepted to have put these in place in the adoption of ICTs. Figure 4.7 illustrates the responses to the measures put in place by organizations on the adoption of ICTs for project management.

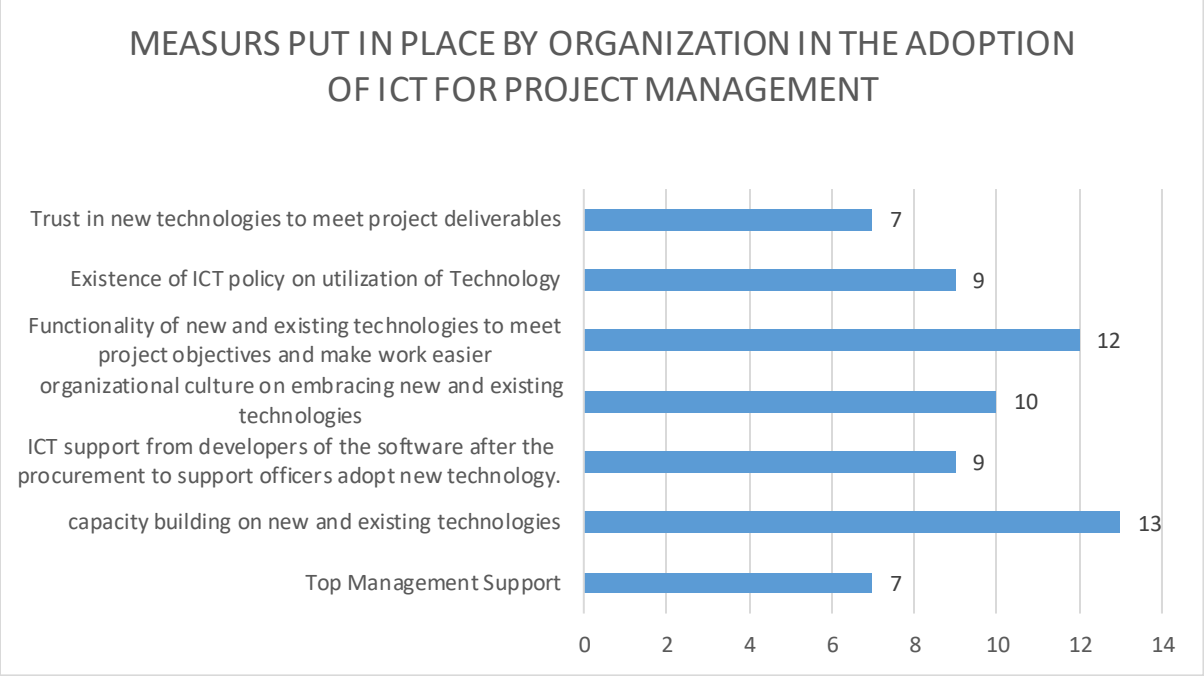

Figure 4. 7 Measures put in place by organizations in the adoption of ICT for project management

4.11 Institutions deliberate policy on employing staff with ICT skills

Given the measures, policy drives direction on expectations of employees in organizations and companies. The respondents were requested to provide a response on whether their organization had a deliberate policy on employing staff with ICT skills. 36.7% had employed a deliberate policy to employee staff with Skills in ICT. 53.3% were did not have a deliberate policy with 10% of the respondents not sure on the existence of the policy. The figure 4.8 indicates the distribution.

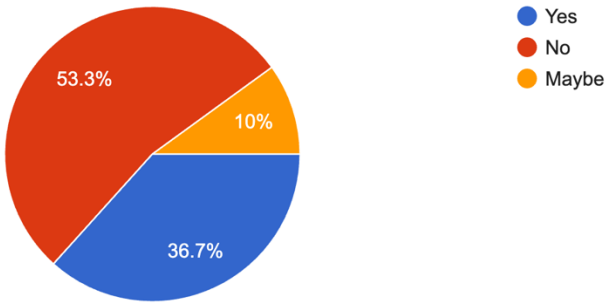

Figure 4. 8 deliberate policy by management on employing staff with ICT skills

4.12 Level in which institutions incorporate the utilization of ICTs at each stage of the project life cycle, i.e., Initiation, planning, execution, monitoring and control, and closing stage.

The utilization of ICTs in Project management can occur at various stages during the project i.e., initiation, planning, execution, monitoring and control, and closing. The respondents were, therefore, asked to identify at which stage their institutions incorporated the utilization of ICTs.

During the initiation stage, the utilization of ICTs was seen to be medium by most of the respondents. During the planning stage, the utilization of ICTs was seen to be high. The trend also indicated medium utilization of ICTs during the execution and monitoring and control stages of the project and finally a very low indication in the use of ICTs during the closing stages of the project. The figure 4.9 indicates this distribution as it was segmented into the four stages for the respondents to provide a response on their use if ICTs at each stage during their project's lifespan.

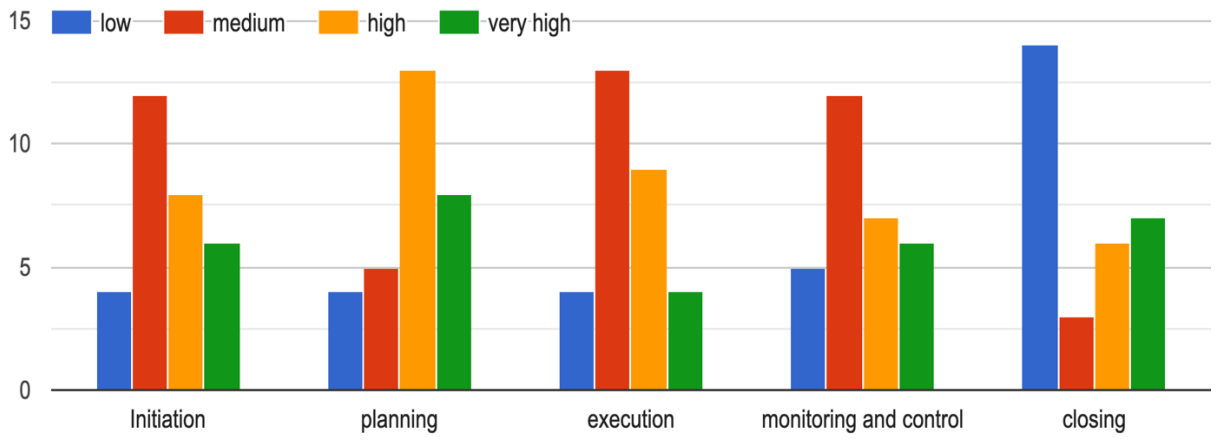

Figure 4. 9 Level in which institutions incorporate the utilization of ICTs

4.13 Awareness on types of ICTs in Project Management

Given the diversity of Technology, the ICT tools can be segmented into various categories serving different purposes. The respondents were requested to provide a response on the awareness of these ICT applications.

Seventy percent (70%) of the respondents were aware of the Project management applications, this was followed by 43.3% of the respondents indicating that they were

aware of knowledge management-based applications. 36.7% were aware of modelling-based support systems. Low awareness levels were on decision-based support and simulation-based ICT applications with 30% representation as indicated in the figure 4.10.

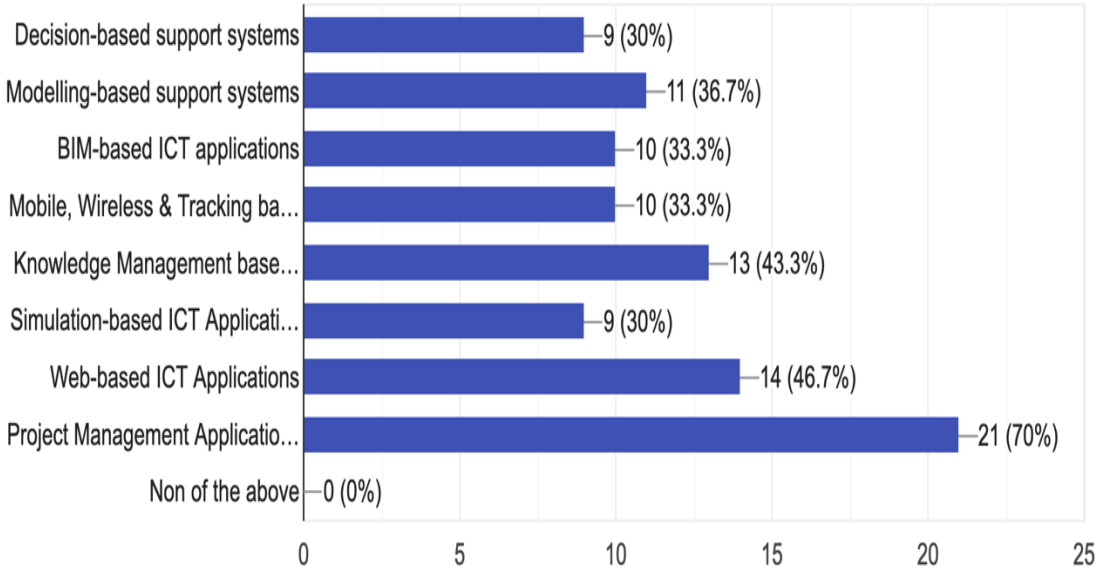

Figure 4. 10 Respondents awareness levels on the types of ICT in project management

4.14 Respondents Utilization of ICT in project management

Respondents were requested to provide a response on the utilization of the tools in which they utilized. 73.3% indicated the use of project management applications among other applications. The use of simulation modelling based support systems were seen to be used by 30% of the respondents. The use of BIM-applications, mobile wireless and tracking based systems, as well as knowledge management-based applications was in use but only at 23.3% as indicated in the figure 4.11.

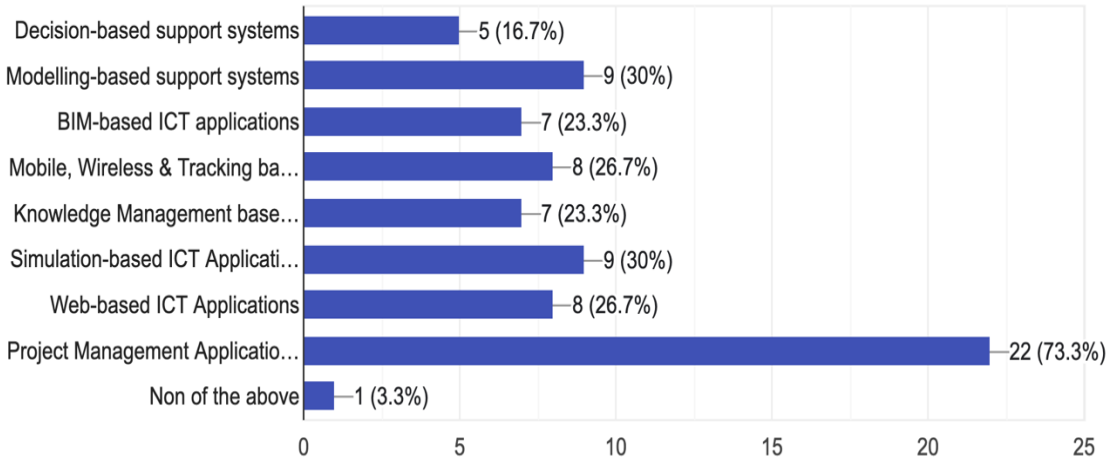

Figure 4. 11 Respondents utilization of ICT in project management

4.15 Classification of level of knowledge in the utilization of ICTs for project management.

The level of knowledge in the use of ICTs among the respondents was fair from the responses provided as indicated in figure 4.12 with 43.3% stating that they had a fair level of knowledge. 30% indicated that they had a good knowledge in the utilization of ICTs for project management. 20% were very good and 6.7% stating that their level of knowledge was below average.

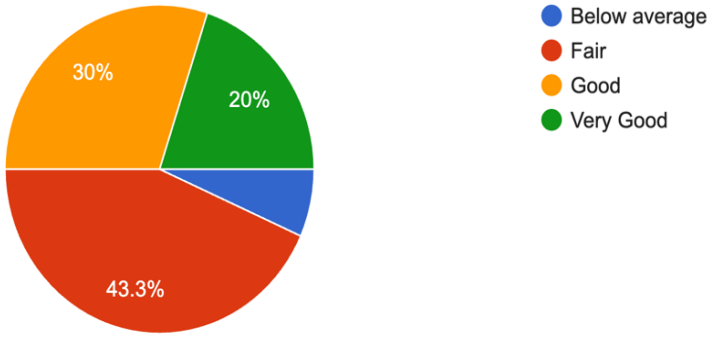

Figure 4. 12 Respondents classification of level of knowledge in the utilization of ICTs for project management

4.16 Acceptance on impact of ICTs (Software & Hardware) in Quality and delivery of service on projects.

93.3% of the respondents acknowledged the impact of ICTs on the quality of service delivered on projects and 7% did not accept.

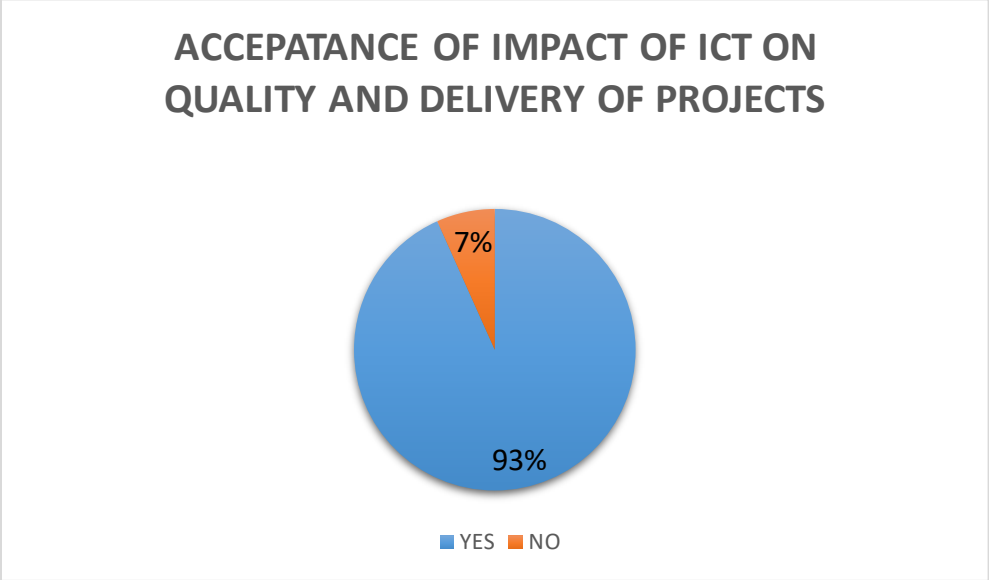

Figure 4. 13 Respondents acceptance on the impact of ICTs in quality and delivery of service on projects

4.17 Challenges in adoption of new technologies in Construction Industry

The respondents were asked to provide their thoughts on various challenges in the adoption of new technologies in the construction industry. The figure 13 indicates the challenges experienced. Based on the feedback provided, 63.3% of the respondents indicated the inadequacy of skills among officers on projects. This was followed by the inadequate capacity building on new and existing technologies representing with 50% of the respondents in agreement. Cultural challenges and resistance to change, inadequate support from Top Management to procure software during the projects for operations and the inadequate ICT support from developers after the procurement of software to support adoption of new technology also stood as a common challenge among the respondents at 46.7%. 36.7% of the respondents indicated the insufficient time to adopt new technologies against project deliverables and objectives. Lack of ICT policy, employee attitudes towards the adoption of new technologies, and education were in the 30th percentile. The lack of trust in new technologies and the inadequacy of new technologies stood to be the lowest at

23.3% and 16.7% respectively. The figure 4.14 indicates the frequency of the challenges.

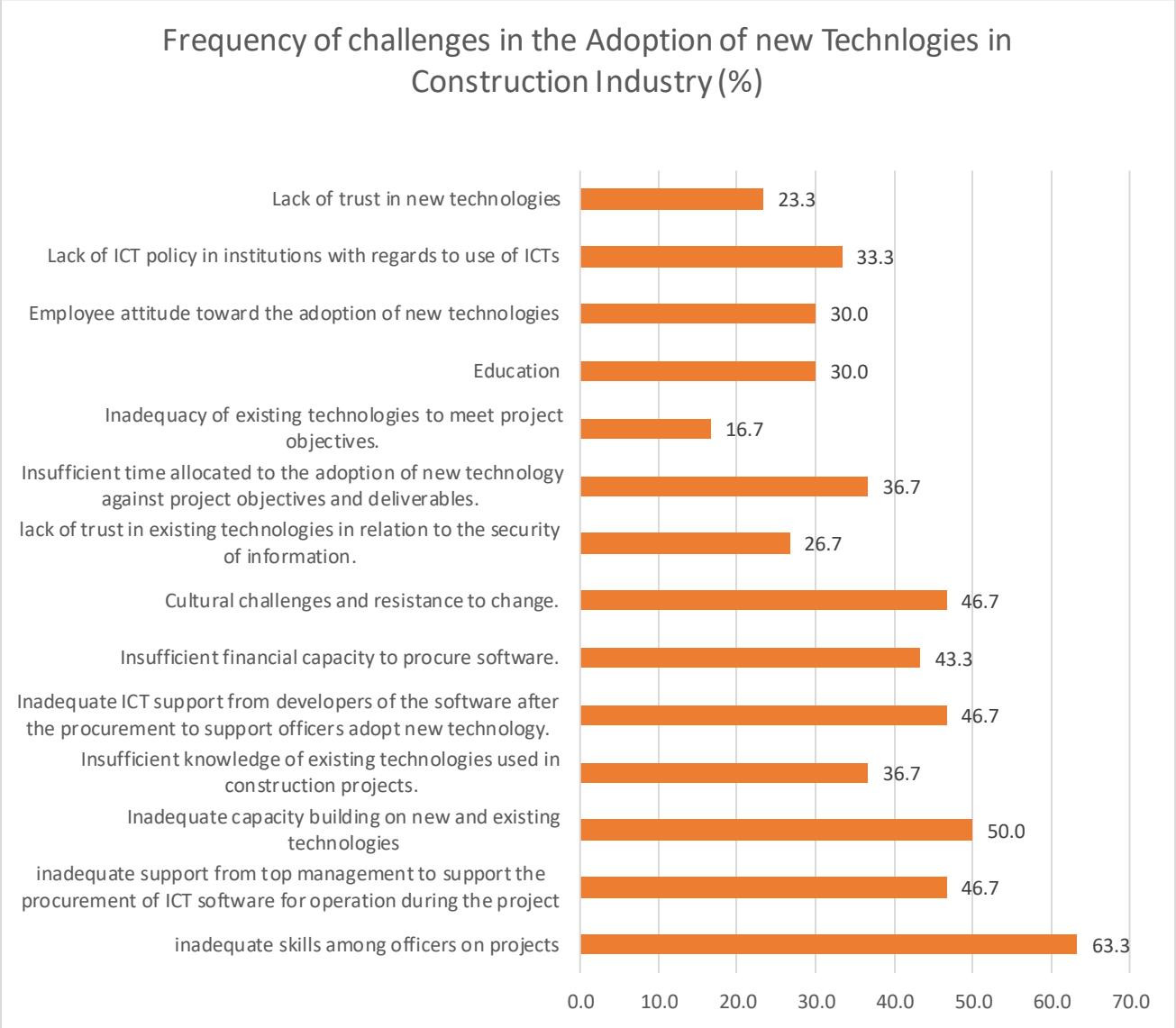

Figure 4. 14 challenges in the adoption of new technologies in the construction industry

4.18 How the construction industry be incentivized to adopt use of ICTs for project management in its own industry.

The respondents were asked to provide their thoughts on how the construction industry can be incentivized to adopt the use of ICTs in project management. The table 4.2 provides the responses provided.

Table 4. 2 Measures that can be put in place to adopt the use of ICTs for project management in the construction industry.

S/N	How construction industry can be incentivised to adopt the use of ICTs in Project management
1	Formulate a deliberate ICT policy in construction industry
2	Enhance policies within the organisation that seek to enhance the use of ICT
3	By adopting new ICTs for projects management, Management will be inclined to provide adequate and much required training for further use of them. This would also increase efficiency and ensure minimal delays in project management as every stage would be automated
4	By investment in technology
5	There needs to be capacity building for key players in the construction industry, that lack the knowledge of how ICT can make the industry more efficient
6	The Construction industry can be motivated by ensuring that officers involved in a project are well trained and Management should support the use of ICTs in the project. This will also improve the quality of work.
7	Capacity building in predesign. Making sure all required software is readily available.
8	The use of ICTs in this industry is important for organisations to maintain their market share and improve their efficiency. More effort needs to be made by management to keep up with emerging technologies. Stiffer competition on the local market and easy access to ICTs will improve adoption rates.
9	Incorporation of ICT tools in universities
10	Conduct more capacity building within organizations to embrace ict
11	By educating the construction industry on the importance of ICT in project management
12	They should be encouraged more.
13	Common/Public information such as city planning maps, models, permits, approvals should be easily accessible or obtained through use of ICT in the construction industry.
14	Have local developers to offer product support.
15	By conducting training to enable the users have effective understanding
16	Capacity building
17	Need higher specification computers & user training
18	Procuring ICT software and making programs meant for teaching industry experts and software skills.

19	Through educating all levels of employment on construction projects. From the lowest entry grade level to the highest project management level.
20	ICT adoption should be made mandatory, to ensure competitiveness of the sector
21	Workshops
22	The construction industry needs more ICT seminars to influence and educate the importance and ease of using ICT and how it can improve the industry.
23	Funding must be adequate throughout the project life span. Project management tools must be compulsory in universities
24	Provision of deliberate ICT policies on projects
25	Put in place ICT policy in industries and re-enforce the use and adoption of ICTs in organizations.
26	Developing easy to use and cost-effective systems for the small construction organization to be able to acquire.
27	By including more of ICTs in schools
28	Capacity building on the existing and new technologies and training on how to use these technologies can bring about some change in the industry.

4.19 Grouping of Recommendations Based on Roles/specializations from Respondents

4.19.1 Recommendations on strategies to adopt ICTs from Project Management Officers

Table 4. 3 Recommendations on strategies to adopt ICTs based on Project Management Officers

ROLE/Specialisation	Recommendations on strategies to adopt ICTs
Project Manager	Through educating all levels of employment on construction projects. From the lowest entry grade level to the highest project management level.
Project Manager	Have local developers to offer product support.
Project Manager	By investment in technology
Project Manager	There needs to be capacity building for key players in the construction industry, that lack the knowledge of how ICT can make the industry more efficient
Project Officer	Capacity building in pre design. Making sure all required software is readily available.
Project Officer	Common/Public information such as city planning maps, models, permits, approvals should be easily assessible or obtained through use of ICT in the construction industry.

4.19.2 Recommendations on strategies to adopt ICTs from Architects.

Table 4. 4Recommendations on strategies to adopt ICTs based on Architects

Role/specialisation	Recommendations on strategies to adopt ICTs
Architect	By including more of ICTs in schools
Architect	Not sure
Architect	Enhance policies within the organisation that seek to enhance the use of ICT
Architect	Conduct more capacity building within organizations to embrace ICTs

4.19.3 Recommendations on strategies to adopt ICTs from Civil Engineers

Table 4. 5 Recommendations on strategies to adopt ICTs based on Civil Engineers

Role/specialisation	Recommendations on strategies to adopt ICTs
Civil Engineer	By adopting new ICTs for projects management, Management will be inclined to provide adequate and much required training for further use of them. This would also increase efficiency and ensure minimal delays in project management as every stage would be automated
Civil Engineer	Capacity building
Civil Engineer	They should be encouraged more.
Civil Engineer	Procuring ICT software and making programs meant for teaching industry experts said software skills.
Civil Engineer	By conducting training to enable the users have effective understanding
Civil Engineer	Capacity building on the existing and new technologies and training on how to use these technologies can bring about some change in the industry.
Civil Engineer	Need higher spec computers & user training
Civil Engineer	Formulate a deliberate ICT policy in construction industry
Civil Engineer	Provision of deliberate ICT policies on projects
Civil Engineer	The construction industry needs more ICT seminars to influence and educate the importance and ease of using ICT and how it can improve the industry.

4.19.4 Recommendations on strategies to adopt ICTs from Clients and consultants

Table 4. 6 Recommendations on strategies to adopt ICTs Based on Clients

Role/specialisation	Recommendations on strategies to adopt ICTs
Client	Funding must be adequate throughout the project life span. Project management tools must be compulsory in universities
Client	By educating the construction industry on the importance of ICT in project management
Client	The Construction industry can be motivated by ensuring that officers involved in a project are well trained and Management should support the use of ICTs in the project. This will also improve the quality of work.
Consultant	The use of ICTs in this industry is important for organisations to maintain their market share and improve their efficiency. More effort needs to be made by management to keep up with emerging technologies. Stiffer competition on the local market and easy access to ICTs will improve adoption rates.
Consultant	Incorporation of ICT tools in Universities

4.19.5 Recommendations on strategies to adopt ICTs from IT personnel

Table 4. 7 Recommendations on strategies to adopt ICTs based on IT personnel

Role/specialisation	Recommendations on strategies to adopt ICTs
ICT adviser	Put in place ICT policy in industries and re-enforce the use and adoption of ICTs in organizations.
IT	Developing easy to use and cost effective systems for the small construction organisation to be able to acquire.

4.19.6 Recommendations on strategies to adopt ICTs from Quantity Surveyors

Table 4. 8 Recommendations on strategies to adopt ICTs based on Quantity Surveyors

Role/specialisation	Recommendations on strategies to adopt ICTs
Quantity Surveyor	Workshops
Quantity Surveyor	ICT adoption should be made mandatory, to ensure competitiveness of the sector

4.20 Chapter summary

Chapter four presented the results from the questionnaire. This was presented in areas related to ICT with a focus on project management in the construction industry. Results indicated areas such as knowledge of ICTs, factors affecting the Utilization of ICTs and related challenges. Further, respondents provided incentives that can be used to promote the utilization of ICTs for project management in the construction industry.

CHAPTER FIVE
DISCUSSION OF FINDINGS

5.1 Introduction

The chapter presents the results based on the findings from the questionnaire which was distributed and completed by thirty (30) practitioners involved in projects in the construction industry. The purpose of this research study was to establish the factors affecting the adoption of ICT in projects management in the construction industry. This chapter discusses the major findings from the research and explains how the information helped in providing responses to the research questions.

5.2 Factors affecting the adoption of ICT in project management for construction.

The first specific objective was to identify factors affecting the adoption of ICT in project management for construction projects in Lusaka.

5.2.1 Factors affecting the adoption of ICT for project management in the construction industry.

Respondents were asked to provide information on their level of skillset in relation to the utilization of ICTs in their roles on projects in project management. All the respondents described their ICT skills to be above average with 43.3% of the respondents describing their skills to be good, 30% to of the respondents described their skills to be fair and 23.7% had indicated that they were very good. The respondents were further requested to provide the years of experience they had in the utilization of ICTs. The majority of the participants had work experience between 5 and 10 years, and below 5 years.

Respondents were asked to describe their skillset in relation to their utilization of ICT on their roles in project management. The results indicated that the majority of practitioners were good at using ICTs on their projects. Further, 43.3% of the respondents indicated to have experience in the utilization of ICTs between 6 years and 10 years.

The respondents were further asked what measures were put in place by their organizations to adopt ICTs for project management. The 13 out of 30 respondents, representing 43.4%, indicated the use of capacity building on new and existing

technologies. This was followed by an assessment of the functionality of new and existing technologies in meeting project objectives and if they make work easier. Culture was also seen to play a role among the measures put in place in the adoption of ICTs for project management with 33% of the respondents indicating the change in organizational culture to embrace ICTs in business processes as this drives employee behavior towards adoption of ICTs. Culture was also highlighted in research conducted by Francis G. Kakumba (2018), where organizational culture was linked to the failure in the implementation of innovation in organizations. Respondents also made mention that the existence of ICT policies on the utilization of ICTs, as well as ensuring support from developers of software after the procurement of ICTs to meet project demands. Only 23.3% of respondents indicated that their adoption of ICTs is based on top management support and trust in both new and old technologies. These measures were found to be insufficient by respondents. This was evident with the follow up question on whether the organizations put in place a deliberate policy on employing staff with skills in ICTs with 53% of the respondents stating the non-existence of an ICT policy in place to promote the use of ICTs in their processes.

ICTs can be used at different stages of a project through the use of various existing hardware and software applications. The respondents were asked the level in which their institutions incorporate the utilization of ICTs at each stage of the project life cycle, i.e., Initiation, Planning, Execution, Monitoring and Control, and Closing stages (Project Management Institute, 2017). An analysis of the results, as indicated in figure 9, based on individual stages that a project undergoes in a project lifecycle, revealed that a majority of the respondents have medium utilization of ICTs during the initiation, execution and monitoring and control stages of their projects. There was, however, an indication of a very low utilization of ICTs during the closing stage of their projects.

Given the diversity of ICTs and how various technologies can be used at different stages of a project, the respondents were asked on the awareness levels of existing ICTs. ICT application classification is a useful strategy for managing the complexity of the technology landscape. It is for this reason that these tools were categorized

based on their purpose for this research and obtains appropriate feedback. The categorizations included Decision Support Systems, Modelling-Based Support Systems, BIM-based ICT applications, Mobile Wireless and Tracking Based Technologies, Knowledge Management-Based Applications, Simulation-Based ICT Applications, Web-Based ICT Applications and Project Management Applications.
The levels of knowledge on project management applications such as Microsoft project was appreciated by 70% of the respondents. However, there were low levels of awareness on Simulation Based ICT based applications and Decision Support Systems among the respondents.

A follow up question was asked to provide information on the utilization of these technologies in their organizations and on their projects. The use of Project Management Applications such as Microsoft project, Asana, and Wrike, among others, was very high, with 70% acknowledging the use of these applications. Further analysis of the awareness against the utilization of ICTs indicated that there was low utilization of the existing ICTs. The results also indicate a gap that needs to be bridged between awareness and utilization of ICTs to enhance the adoption of ICTs on project management in the construction industry.

In addition, respondents accepted the impact of ICTs on project outcomes with 93% accepting the impact ICTs have on quality of service delivered projects. This was also evident as provided for in research conducted by Ganesh Paudyal (2016), where he highlighted the merits of the use of ICTs in construction and its overarching role in the delivery of projects.

5.3 Justification on the challenges affecting adoption of use of ICTs for own projects management within the construction industry.

Respondents were asked to provide responses on challenges in the adoption of ICTs for project management in the construction industry. The inadequacy of skills among players on projects was recognized to be a common challenge faced among the respondents (63.3%). Capacity building was also seen to be prominent among the respondents (50%). Cultural challenges and resistance to change, inadequate support from top management, procurement of software during the project from

developers of software, and insufficient financial capacity to procure software were seen to been among the challenges faced by 40% to 49% of the respondents.

The lack of an ICT policy with regards to the use of ICTs, employee attitude towards the adoption of ICTs, education, insufficient knowledge on new and existing technologies, and insufficient time allocated to adopt new technologies against project objectives and deliverables was seen to be a challenge among 30% to 39 % of the respondents. A well-structured ICT policy provides a platform for employees to trust technologies as well as provide a drive towards the perceived usefulness and perceived ease of use. Technology acceptance can be determined by the perceived use and interest by the practitioner for a given technology, whereas insufficient knowledge may also have a bearing on how practitioners adopt these technologies. In view of the complexity of some projects and the timeframe allocated to a given project, the introduction of technologies during a project can be seen as a challenge as a practitioner needs to allocate time to learn a given technology to use on the project against overall project deliverables and deadlines. According to 23% of the respondents, there still existed a lack of trust in new technologies.

5.4 How the construction industry can be incentivized to adopt use of ICTs for project management in its own industry.

Respondents provided mechanisms that could be put in place to adopt the use of ICTs in project management in the construction industry. This was to provide a practical approach, based on their professional experience with a view to enhance the adoption of ICTs in the construction industry and their project management.

5.4.1 Recommendations based on specializations

The study provided recommendations from various stakeholders selected for the study. Considering the different stakeholders, it was imperative to obtain a perspective and embrace measures and strategies to improve the adoption of ICTs.

5.4.1.1 Recommendations from Projects Management Officers

Projects management officers indicated the need for education through training at all levels in the value chain. The support to all levels ensures efficiency in operations

especially on tools that require all levels of employees to maximize utilization and appreciate ICTs. There was also an indication for local developer to provide product support. Offering product support from local developers facilitates for cost saving and potentially provides efficiency in responding to challenges because of the geographical location. There was also a request for the investment in technology. The investment in technology comes from leaders in institutions providing support towards the procurement of software applications that would meet project objectives and putting into consideration requests from employees on tools that they need to conduct their duties efficiently capacity building during predesign as indicated by one of the project management officers would assist in ensuring that software is made available before implementation of construction projects. The acquisition of necessary tools and software ahead of the project reduces bottlenecks associated with procurement processes in searching and getting software during implementation. There was also a proposal for the availability of information that should be made relevant to enable project officers conduct their work through the use of ICT. This proposal is directed towards the use of knowledge management systems that store information for long periods of time as well as development of databases that can easily be accessed. The use of website applications by other stakeholders can also be provided to ensure data is accessed from anywhere putting into consideration ICT security to access critical information.

5.4.1.2 Recommendations from Architects

Architects recommended the review of curriculums in learning institutions to incorporate ICTs. The inclusion of ICTs in learning institutions ensure graduates have the necessary ICT skills as they join the industry. The benefit of introducing these skills and exposure to various technologies I these institutions reduces costs by institutions in terms of capacity building and training of employees. Other benefits include a reduction in time, cost and would provide enhanced efficiency in project quality and delivery because the requisite skills would already be inculcated in employees. There was also a proposal to provide policies among institutions. policy guides the way people behave in an environment and shape the culture that should be inculcated among employees. The enforcement of ICT policies assists in embracing ICT and indicate the expectations from employees towards the adoption of ICTs. There was also a proposal for capacity building among employees to

enhance ICT skills on new and existing technologies. Capacity building support competition as they ultimately ensure that through ICTs, quality, cost and value is obtained In the delivery of projects and project management.

5.4.1.3 Recommendations from Civil Engineers

Civil engineers proposed for the provision of Top Management support in incorporating ICTs on projects in the construction industry was highlighted by all the respondents based on their specializations. Top management support involves allocation of resources to support the adoption of ICTs as well as creation of a culture that embraces ICTs. Formulation of a deliberate policy was also highlighted as a factor affecting the adoption. Policy guides business processes and who to employ and with hat skills to improve project outcomes through the use of ICTs. They also proposed capacity building and automation of processes in the industry with the awareness that this ultimately provides efficiency and effectiveness in project delivery. They also proposed the encouragement in the use of ICTs. This can be done by providing incentives such as rewards, scholarships and sponsorships on acquiring ICT skills. Civil engineers also propose the investment in infrastructure which was directed towards support on not only procuring computers, but the procurement of high specification computers that meet the demands of their work. ICT software applications come with various minimum specifications to be utilized, therefore, it is imperative that the procurement of infrastructure meet the needs of the software required to ensure efficiency in meeting the overall project demands the use of ICT policies was also highlighted by this segment. The investment in seminars assist in bridging the gap between awareness and utilization of ICTs.

The respondents indicated the Investment in capacity building on key players to improve efficiency in delivery of project objectives at every stage of projects would assist in the adoption. This can be done through facilitating conducting continuous training among employees, the adoption of ICTs can improve by tailoring them to the needs of the project and the organisations goals and objective. Identification of innovators, early adopters, early majority, and late majority would assist in embracing ICTs. identifying key employees that will steer the adoption of ICTs.

5.4.1.4 Recommendations from Clients and Consultants

Clients and Consultants were also part of the study and they proposed some strategies that would contribute towards the adoption of ICTs. They proposed the compulsory use of project management tools in higher learning institutions before students join the industry. They also provided a suggestion on education of existing technologies and their contribution to the construction industry. Awareness raising on existing and new technologies facilitates appreciation and through training, new technologies can be utilized effectively. The clients emphasized on the need for training and more effort from management with the benefit towards efficiency through the adoption of ICTs. They also elaborated on other benefits such as stiffer competition that comes with ICTs and more market share through their use.

5.4.1.5 **Recommendations from IT Personnel**

IT personnel are responsible for the development, training and support of ICTs in various industries. The IT segment of the respondents recommended the need for re-enforcement of policies among institutions towards the use and adoption of ICTs. There was also a proposal on developers to develop easy to use and cost-effective systems for SMEs. Costs associated with the procurement of ICTs can be very high. However, opportunities lie with local ICT developers to provide software applications that meet the demands of SMEs in the construction industry that is affordable and meet the demand.

5.4.1.6 Recommendations from Quantity surveyors

Quantity surveyors recommended the need for workshops on new and existing ICTs to enhance their skills. They further recommended for the ICTs to be made mandatory on projects for effective project management. this was with a view to be competitive. some workshops provide a focused approach towards the acquisition of specific skills relevant to a sector or group of employees, as well as benefits associated with new and existing technologies.

5.5 Chapter summary

Factors affecting the adoption of ICT for project management in the construction industry can be attributed to various reasons. This chapter presented discussions from the findings on factors affecting the adoption of ICTs in project management I the construction industry. It can be concluded that the inadequacy of skills among personnel on projects was prominent among the respondents and was highlighted to be among the factors affecting the adoption of ICTs for project management in the construction industry. This can be attributed to the insufficient investment in capacity building in their institutions. The investment on capacity building comes from Top management support to acknowledge and appreciate the need to onboard skills development programs to benefit project officers and the overall project success. The results also indicate a variation that exists between awareness and utilization. Bridging the gap between awareness and utilization would assist in the adoption of ICTs on projects. Further, respondents provided mechanisms that could be put in place to adopt the use of ICTs in project management in the construction industry. The responses include formulation of a deliberate ICT policy among institutions to employ stuff with relevant skills, top management support to embrace ICTs and invest in capacity building on the use of ICTs, review of curriculum in learning institutions to incorporate ICTs in school of engineering, and continuous sensitization on various applications of ICTs and how they benefit project management in the construction industry. The implementation of these measures has been seen to contribute towards the adoption of ICTs for project management in the construction industry.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the research study conclusion with recommendations based off the findings and discussion. The focus of the research was to determine the factors affecting the adoption of ICTs for project management in the construction industry.

The following conclusions were drawn from the responses received:

Stakeholders involved on projects experienced challenges in the adoption of ICTs and this resulted from various factors which include the inadequacy of investment in capacity building, levels of skillset on ICTs among project management practitioners, experience on the utilization of ICTs, inadequate interventions put in place to adopt ICTs, absence of deliberate polices to employ staff with ICT skills, levels in which institutions incorporate ICTs at different stages of the project, and categories in the utilization and awareness of ICT for project management in the construction industry. Among these factors, it was evident that top management support and capacity building were highlighted to be affecting different areas of specialization which poses a challenge for management to provide measures to address the adoption of ICTs for their project management.

There exists a gap between awareness and utilization of ICTs in project management in the construction industry. The existence of this gap provides an opportunity for investment opportunities towards capacity building as well as a proactive approach in appreciating the benefits that ICTs bring to processes and procedures such as reduction in the wastage of materials resulting from the use of software applications such as BIM applications and modelling and system design software providing accuracy in design and quality.

The procurement of software and after sales support from developers was also underlined to be among the reasons affecting the adoption of ICTs. The absence of support after procurement of ICT equipment affected its use if the user experiences challenges in communicating and addressing challenges with functionality.

The complexities of the challenges on the adoption of ICTs possess an effect on various aspects of projects in the construction industry as the underutilization of ICTs affects areas that could otherwise, be leveraged from adopting ICTs to improve processes at different stages of a project. The effective use of the ICT applications by Project Officers, Architects, Quantity Surveyors, Consultants, ICT Personnel, and Civil Engineers demonstrated in this study all provide benefits such as prevention of cost overruns through the provision of real time tracking and monitoring of resources, better planning and budgeting trough project management applications, enhanced design an quality of projects, and knowledge based information systems which assist in providing the best methods through rich data sets that can be analysed through complex computations within a short period.

The assessment of the various forms of ICTs should be an eye opener, and the use of the different categories of ICTs at different stages of the project management lifecycle, would assist project practitioners in taking an active approach towards selection of appropriate tools to use. It is also imperative that the time is invested in creating an enabling environment for project practitioners to learn the new technologies. The factors identified to be prominent, and the feedback provided by the respondents in this research provided a baseline on the factors that surround adoption and utilization of ICTs in the construction industry and express the position that players in the project face in embracing ICTs for the benefit of the project and meeting project deliverables. In addition, the development of an ICT policy will guide in ensuring that both new, and existing project practitioners on project embrace the various forms of ICTs. The deliberate enforcement of an ICT policy will ensure that they make necessary efforts in adopting ICTs and improve the skills in ICTs. The investment in seminars and workshops on new and emerging technologies will provide for new methods of working and delivering projects on time and on the budget and within the scope. These new technologies accommodate efficiency and effectiveness through the use of digital platforms.

6.2 Recommendations

The study recommended mechanisms, based from the responses from the respondents, that can be put in place to adopt the utilization of ICTs in project management in the construction industry are as follows:

1. Provision of Top management support in incorporating ICTs on projects in the construction industry. The results indicated that the there is need for top management to understand and use ICTs to gain a competitive advantage on the market and embrace ICTs on projects.

   Top management support includes allocation of resources towards ICT tools, procurement of new technologies within the organization for employees, providing change management strategies and fostering a culture of innovation.
2. Investment in capacity building on key players to improve efficiency in delivery of project objectives at every stage of projects. capacity building includes provision of training and workshops to train employees on new and existing technologies.
3. Capacity building in predesign. Making sure all required software is readily available.
4. There must be continuous sensitization on the importance and utilization of ICTs in the construction industry. Sensitization will assist in bridging the gap between awareness and utilization of ICTs on projects in the construction industry. Sensitisation provide a platform for change management and technology readiness awareness measures.
5. Formulation of a deliberate policy. This will guide business processes and who to employ and with what skills to improve project outcomes through the use of ICTs.
6. The Investment in more ICT seminars in the construction industry to influence and educate the importance and ease of using ICT and how it can improve the industry. Seminars provide for employees and individuals to learn and know new technologies.
7. Review of curriculum in learning institutions to incorporate ICTs. The use of ICT tools in learning institutions before producing graduates would provide the

required skills and improve the adoption and utilization of ICTs in the industry. This would subsequently improve delivery of projects.

8. Developing easy to use and cost-effective systems for the small construction organisation to be able to acquire.
9. Incorporate locally built ICT systems and tools and have local ICT support on products after procurement.

The researcher proposes these interventions to be put in place through a continuous approach towards capacity building and sensitization on the utilization of ICTs. Application of the right tools during the different stages of the project management cycle will assist in the delivery of quality of projects.

6.3 Possible Future Research

The results indicate that, considering the variety of ICTs, one area that may be explored for potential future research is the creation of a strategic framework to facilitate the provision of ICT skills to project management professionals in the construction industry. The application of the measures prescribed by the respondents to enhance the adoption of ICTs can be used to assess which of them is more influential regarding the adoption of ICTs in the construction industry and thereafter, provide a focus area for project managers to invest more in a particular method. The researcher recommends by the assessment of the utilization of the categories of ICTs provided in the research by focusing on a single category and the software applications that fall under them as this research provided a higher-level view of the variety of ICTs and their adoption in the construction industry. Other areas also include the study of how different stakeholders in the project management process flow utilize ICTs. With the advancement of ICTs such as Artificial Intelligence, the study of how Artificial intelligence has impacted project managers in Zambia, as well as the rate at which some processes that are automated would also assist determine Zambia's position in terms of technology readiness in relation to Artificial Intelligence for project practitioners.

6.4 Limitation of the study

It is pertinent to acknowledge the limitations of the study which have an impact on generalizability of the research findings. The research was conducted with a focus on a limited number of stakeholders in the construction industry involved on projects and project management namely consultants, Civil engineers, Project management officers, IT consultants, and Quantity surveyors. Therefore, there results may vary based on an increase in stakeholders such as accountants, Human resources officers that have administrative roles on projects in the industry as they also make use of ICTs to perform their roles. Additionally, the study was conducted on the basis of self-reported data from survey interviews which could be subject to respondent bias. A bigger sample size could be employed in future research to address challenges and utilizing mixed methods approach to review and validate findings. The use of closed-ended questions provided potential limitations to the opinions on challenges faced in the industry for instances where the respondents could have challenges outside the scope of the options provided. Further, the study was only focused on Lusaka district, therefore, the data collected and interpreted could be subject to contextual specificity and dynamics related to culture and environmental contexts.

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APPENDICES

Research Questionnaire

select your gender *

- ◯ Female
- ◯ Male

what role do you play in the construction industry *

- ◯ Civil Engineer
- ◯ Architect
- ◯ Project Manager
- ◯ Quantity Surveyor
- ◯ Project Officer
- ◯ Consultant
- ◯ Client
- ◯ Supplier
- ◯ Other: _____

what age group do you belong to *

- ◯ 18-25 years
- ◯ 26-35 years
- ◯ 36-45 years
- ◯ 46-55 years
- ◯ Above 55 Years

Highest qualification obtained *

- ◯ certificate
- ◯ Diploma
- ◯ Bachelors Degree
- ◯ Masters Degree
- ◯ PhD

How would you describe your skillset with respect to the utilization of ICT for your role on the projects under the organization? *

- ◯ Below Average
- ◯ Fair
- ◯ Good
- ◯ Very good

How many years of experience do you have in the utilization of existing ICT software and hardware in your current role on projects? *

- ◯ Less than 5 years
- ◯ 6-10 years
- ◯ 11-15 years
- ◯ Above 15 Years

What measures, if any, has your organization/institution put in place to assist project officers adopt new technology during projects? *

- ☐ Top Management Support
- ☐ capacity building on new and existing technologies
- ☐ ICT support from developers of the software after the procurement to support officers adopt new technology.
- ☐ organizational culture on embracing new and existing technologies
- ☐ Functionality of new and existing technologies to meet project objectives and make work easier
- ☐ Existence of ICT policy on utilization of Technology
- ☐ Trust in new technologies to meet project deliverables

Does the institution have a deliberate policy towards employing staff that have ICT skills in specific tools/programs in construction? *

- ◯ Yes
- ◯ No
- ◯ Maybe

What is the level in which your institution incorporates the utilization of ICTs at each stage of the project life cycle? i.e., Initiation, planning, execution, monitoring and control, and closing stage? *

	low	medium	high	very high
Initiation	◯	◯	◯	◯
planning	◯	◯	◯	◯
execution	◯	◯	◯	◯
monitoring and control	◯	◯	◯	◯
closing	◯	◯	◯	◯

Which of the following types of ICTs are you aware of that assist in Project Management? *

- [ ] Decision-based support systems
- [ ] Modelling-based support systems
- [ ] BIM-based ICT applications
- [ ] Mobile, Wireless & Tracking based ICT Applications
- [ ] Knowledge Management based ICT Applications
- [ ] Simulation-based ICT Applications
- [ ] Web-based ICT Applications
- [ ] Project Management Applications e.g., Microsoft Project
- [ ] Non of the above

Which of the following ICT applications do you use during the project lifespan? *

- [ ] Decision-based support systems
- [ ] Modelling-based support systems
- [ ] BIM-based ICT applications
- [ ] Mobile, Wireless & Tracking based ICT Applications
- [ ] Knowledge Management based ICT Applications
- [ ] Simulation-based ICT Applications
- [ ] Web-based ICT Applications
- [ ] Project Management Applications e.g., Microsoft Project
- [ ] Non of the above

At what stage of the construction project is ICT utilization prominent in your projects? *

	Low	Medium	High
Predesign	○	○	○
Design	○	○	○
Construction planning	○	○	○
Construction	○	○	○
Operation	○	○	○
Maintenance	○	○	○

How would you classify your level of knowledge in the use of ICT applications for project management? *

- ◯ Below average
- ◯ Fair
- ◯ Good
- ◯ Very Good

Have the ICT tools (both software and hardware) improved the quality of service delivery on projects?

- ◯ Yes
- ◯ No

Why does the construction industry have challenges adopting the use of ICTs for its own projects management? *

- [ ] inadequate skills among officers on projects
- [ ] inadequate support from top management to support the procurement of ICT software for operation during the project
- [ ] Inadequate capacity building on new and existing technologies
- [ ] Insufficient knowledge of existing technologies used in construction projects.
- [ ] Inadequate ICT support from developers of the software after the procurement to support officers adopt new technology.
- [ ] Insufficient financial capacity to procure software.
- [ ] Cultural challenges and resistance to change.
- [ ] lack of trust in existing technologies in relation to the security of information.
- [ ] Insufficient time allocated to the adoption of new technology against project objectives and deliverables.
- [ ] Inadequacy of existing technologies to meet project objectives.
- [ ] Education
- [ ] Employee attitude toward the adoption of new technologies
- [ ] Lack of ICT policy in institutions with regards to use of ICTs
- [ ] Lack of trust in new technologies
- [ ] Other:

How can the construction industry be incentivized to adopt use of ICTs for project management in its own industry? *

Your answer

UNIVERSITY OF LUSAKA

SCHOOL OF
POSTGRADUATE STUDIES
5TH TO 14TH JANUARY 2024 GBS800 DISSERTATION SUBMISSION

No	Item	Done
1	Were you registered for GBS800 in the JULY-DECEMBER 2023 semester?	**YES**
2	Has your FINAL DISSERTATION been signed by the supervisor[1]?	**YES**
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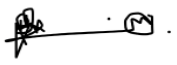
	Signature: 	
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