STRATEGIES FOR IMPLEMENTATION OF CONSTRUCTION MANAGEMENT PLANNING TOOLS FOR EFFECTIVE PROJECT DELIVERY IN ABUJA, NIGERIA

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MINNA

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY (MTech) IN CONSTRUCTION MANAGEMENT

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DECLARATION

I hereby declare that this thesis titled **"Strategies for Implementation of Construction Management Planning Tools in Effective Project Delivery for Abuja, Nigeria"** is a collection of my original research work and it has not been presented for any other qualification anywhere. Information from other sources (published or unpublished) has been duly acknowledged.

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SIGNATURE/DATE

CERTIFICATION

This thesis titled "Strategies for Implementation of Construction Management Planning Tools for Effective Project Delivery in Abuja, Nigeria" by: SALAKO, Bidemi Abdulazeez (MTECH/SET/2019/9675) meets the regulations governing the award of degree of MTech of the Federal University of Technology, Minna and it is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to almighty Allah.

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ABSTRACT

The construction industry cannot overemphasise the importance of construction management planning tools. These tools are fast becoming necessary for the successful implementation of construction projects. It is now time that developing economies like Nigeria mandate the regulated usage of these tools. Projects experience delay or abandonment due to uncertainty in cash flow, unacceptable claims and valuation, delay in payment of workers, and an already built structure that has to be massively renovated to fit for usage due to poor delivery and others gone through complete demolition due to structural defect. These challenges include barriers to adopting construction management planning tools and constraints related to resource availability and technological integration in Abuja, Nigeria. These hinder effective project deliveries, necessitating identifying strategies to address these problems and enhancing the implementation of such tools. This study examined the Strategies for implementing construction management planning tools in effective project delivery in Abuja, Nigeria. The study utilised the mixed method, which comprises quantitative and qualitative methods through a well-structured questionnaire and structured interview as primary and secondary data collection. The study used a probability random sampling technique. One hundred thirteen responses were received through Google form, of which 100 were suitable for quantitative analysis, representing 88.4%, and 10 professionals were interviewed for qualitative analysis. The data collected were analysed on SPSS using factor analysis, means score ranking, content analysis and regression analysis, while the results were presented in tables and content analysis. From the findings, construction management planning tools are in place in Abuja. CT (Classic Technique) is ranked highest with factor loading extraction of 0.820, followed by WM (Waterfall Method) of 0.742. Content analysis was used to show the implementation of these tools, and it was gathered that they were implemented on the Abuja construction site. The barriers were analysed with means score ranking, and CM-Cost Management (mean=5.802; SD=2.455; $t(90) = 8.946$; $p=0.000<0.05$) ranked highest. The drivers of construction management tools showed that government regulation, education and training were key drivers. The strategies for implementation for project delivery were analysed with means score ranking, and regression showed that delivery on time is critical to project delivery using all the listed strategies. In conclusion, there is a need for government regulations to include construction management tools as part of the necessity for construction project approval; companies and organisations involved in construction projects must ensure they use construction management planning tools, training should be regular, and professionals are to be constantly updated as technology progress. Also, private and public should ensure documentation on project construction management planning tools to serve as a reference to ongoing and future projects. The government should implement disciplinary action upon erring companies and organisations that fail to implement construction management planning tools in Abuja and nationwide.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The construction industry in Nigeria remained one of the key players that contribute tremendously to the country's socioeconomic development amid increasing demands for shelter, access roads and other necessary construction projects (Adegbembo and Saka, 2022). The industry focuses more on urban development by constructing real estates, commercial properties, and associated infrastructures. These projects propel the nation's socioeconomic development as it assists in generating employment and the supply of goods, general and professional services (Ofori, 2015). Its products include all structures necessary for shelter, offices and commercial needs, roads and bridges to transport goods and services, and other structures that meet the ever-growing human needs (Okoye *et al.*, 2016).

Despite the critical role the construction industry plays in the nation's development, research shows many challenges facing the industry, resulting in poor project delivery. These challenges include poor design, planning and control, as well as poor coordination, which can be handled by employing construction management planning tools for construction projects (Haugen *et al.*, 2017).

According to Poyhonen *et al.* (2017), late changes to project plan results in conflicts among all the key players on the project. Therefore, Carpenter and Bausman (2016), asserted that project delivery is a comprehensive process where specific responsibilities are assigned in such a way as to specify the scope of the project, contractual responsibilities, inter-

relationships of the parties and the processes for managing time, cost, safety and quality. Ding *et al.* (2018) also agree that projects are executed in phases where parties are assigned roles and responsibilities to ensure proper project delivery. In order to meet the increasing human needs, modern and advanced construction tools are being utilised for projects (Shrout and Rodgers, 2018).

According to Kim *et al*. (2018), construction management tools are like road maps with rules, techniques and methods that help managers by guiding them from one point to another as the project progresses from the beginning to the end. These tools improve efficiency while delivering services. They also guide in the right direction towards achieving the expected project deliverable by enforcing smart working and integrating efficiency (Kim *et al*., 2018). Similarly, the future of construction project management includes developing more sophisticated tools and techniques which will allow project managers to reach the next level of project management (Ajugiya *et al*., 2017).

Construction management encompasses a set of objectives which will be accomplished by implementing strategies of construction management tools; such implementation requires resources potential in managing the change in the industry, and the use associated with computerized expert systems in the industry is increasing widely (Drake, 2013). A Project Management Institute (PMI, 2013) report revealed that organizations undervalue construction management planning and downplay talent development. Therefore, this research seeks to study the influence of construction management planning tools by construction firms in Abuja and how it affects project delivery. Hence, based on the challenges towards the effective utilisation of project delivery tools, this study aims to develop effective strategies for utilising these tools in the Nigerian construction industry.

1.2 Statement of the Research Problem

The Nigerian construction industry is a multibillion-dollar industry with occasional construction work. Some of these projects are building construction for residential, office and commercial purposes. There is also construction of roads and bridges and other such mega projects across the country, especially in Abuja, Nigeria's capital city. Some of these projects involved both foreign as well as indigenous companies.

The yardstick for measuring a project delivery should encompass all of its phases, including planning, designing, building, and post-construction (Olanrewaju *et al*., 2021). Over the years, achieving the anticipated advantages and maintaining standards while managing buildings effectively and efficiently during post-construction activities has been a significant issue.

As time passes, some of these projects' experiences delay or abandonment due to uncertainty in cash flow, unacceptable claims and valuation, delay in the payment of workers, low morale, and so on (Akinsiku and Ajayi, 2016). The nation has witnessed collapse of massive structures and other structures in many places and the Federal Capital Territory has been hard hit with such occurrences.

According to Okoye *et al*. (2016), there has been cases where an already built structure has to be massively renovated to make it fit for usability as a result of poor project delivery, others has gone through complete demolition to allow for complete reconstruction as a result of structural defect.

There are also cases of re-awarding contract to another company due to non-performance of the former, and all these resulted in poor project delivery, enormous waste of time and resources, delay in project completion time, loss of employment (Olatunji *et al.*, 2019).

The literature reports the implementation of strategies in construction management processes is very low with some of the reported challenges facing construction management tools application are the knowledge higher level management techniques in the construction industry (Dang and Le-Hoai, 2019), education and training within company, communication management, procurement management, government support to ensure finance and insurance, insufficient guidelines (Okere, 2017), lack of regulatory policies (Afolabi *et al.,* 2017), lack of experience in implementation of planning tools (Ding *et al.,* 2018), and high cost of implementation (Sela, 2020).

The construction industry has been profitable and has contributed tremendously to the nation's economy despite all these challenges. However, the Nigerian construction industry must improve project delivery to meet an acceptable level commensurate with other developing and developed economies worldwide. To achieve this, it is necessary to research the strategies for implementing construction management planning tools in project delivery, focusing on Abuja, Nigeria. The study seeks to provide answers to the research questions stated below based on these discussions;

i. What are the construction management planning tools currently in use in project delivery in Abuja?
ii. What is the level of implementation of construction management planning tools in construction firms in Abuja?
iii. How to identify the barriers to implementing construction management planning tools effectively in some selected construction firms in Abuja?
iv. How to identify the drivers to implementation of construction management planning tools in project delivery in some selected construction firms in Abuja?

v. What strategies can be adopted for implementation of construction management planning tools in construction firms in Abuja?

1.3 Aim and Objectives

This study aims to assess the strategies for implementing construction management planning tools in Abuja to improve the construction project delivery. In order to achieve this, the following objectives are formulated to:

i. Identify construction management planning tools currently in use in project delivery in Abuja
ii. Assess the level of implementation of construction management planning tools in project delivery in Abuja
iii. Identify barriers to the use of construction management planning tools in some selected construction firms in Abuja
iv. Determine the drivers of construction management planning tools in some selected construction firms in Abuja
v. Propose strategies for implementation of construction management planning tools for effective project delivery in Abuja

1.4 Hypothesis

(i) Null hypothesis $H_{o:}$ There is no significant difference in the opinions of the respondent on the identified implementation of strategies for construction management planning tools and project delivery. Therefore, null hypothesis is rejected.

(ii) Alternative hypothesis H_1: There is significant relationship between the strategies for implementation of construction management planning tools and project delivery. Therefore, is accepted.

1.5 Justification of the Study

The literature has established that there is an existing problem towards the strategies for implementation of construction management planning tools application which has directly or indirectly benefits project delivery from a traditional method of operation. Further application of strategies for implementing planning tools has proven to be a more efficient method to operate. Again, there is a lack of adequate study, training and education in this field, especially in the context of developing countries which literature has recommended further studies.

Future research should consider investigating the challenges towards the strategies for implementation of construction management planning tools in construction activities in other areas with an emphasis on developing countries and carry out comparative studies among different countries (Olateju *et al.*, 2011). Additionally, to have a more generalized results, previous researches have suggested innovative strategies in construction projects to implementation of lean construction techniques for improving construction safety using probability-sampling techniques, root causes of the barriers to check for interrelations among them, as well as developing strategies to overcome those barriers. Based on this recommendation on the knowledge gaps there is a need for this research which intends to assess the level of implementation of construction management planning tools in project delivery to determine strategies for the implementation of construction management planning tools for effective project delivery in Abuja. Similar conclusions have been drawn in other study on the strategies for the implementation of construction planning tools (Idoro and Patunola-Ajayi, 2009).

Investigation into the drivers of construction management planning tools and challenges with implementing the planning tools among construction firms in Abuja, reveal that a lack of client commitment and involvement, Training and education of project managers to implement construction management planning tools are the two main obstacles to implementation of planning tools to project delivery (Ibrahim and Daniel, 2020). In a similar vein, Kissi *et al.* (2016) found that government involvement through introduction of policy, regulation and guidelines are crucial in the implementation of construction planning tools in project delivery. The study also concludes that societal awareness of its benefits and application, construction firm's stakeholder's involvement needs to invest more in removing obstacles and expanding implementation. According to a study by Olatunji *et al.* (2019) strategies for implementation of construction management planning tools enable the construction firm's implementation process achievable in project delivery. To solidify this, more research in the field of strategies for implementation of construction planning tools is required. To increase the productivity of the construction business, Afolabi *et al.* (2017) shows that additional study is needed to strengthen the strategies for implementation of construction management planning tools, which is necessary to fully utilize for project delivery. Hammad *et al*. (2020) concluded that construction management planning tools, if properly implemented, will improve the project delivery outcome in construction firms in Abuja, Nigeria.

However, significant attention needs to be paid to the barriers to its implementation, especially cost management and training expenses. This study was conducted in Abuja, Nigeria to examine additional professionals to obtain a more comprehensive opinion on strategies for implementation of construction management planning tools. Previous studies

assessment of construction management techniques in Nigeria have been conducted in Ibadan, and have recommended future studies be conducted in other regions.

Carrying out this research will further add up to the body of knowledge, as well as benefit the professionals in the construction industry, academia and end users. The outcome of this study will yield a pathway that will guide professionals who are managing construction firms to achieve the expected benefits such as project delivery on time, client satisfaction on service, value for money, communication management, quality management, and performance management. However, neglecting this aspect, the existing problem will continue manifesting, leading to a low level of implementation of construction management planning tool, which will result in poor project delivery, inventory management, stakeholder management, project complexity, and lack of proper experience.

1.6 Scope of the Study

This Study covers the strategies for implementing construction management planning tools for effective project delivery in Abuja.

1.7 Limitations of the Study

This study encountered the following limitations: Some construction firms could not release the professionals' comprehensive contact list due to security reasons. However, a list containing organizations where the professional can be located was acquired. Therefore, the scope of the study is limited to some selected construction firms within Abuja, Nigeria.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Construction Industry

According to Kanyago *et al.* (2017), the construction sector is one of the key industries driving development in both urban and rural areas and advancing national development. Construction-related activities also significantly boost Nigeria's national economy and industrial development as a developing country (Okoye *et al.*, 2016). The construction industry is becoming increasingly important as the backbone of the national economy due to the rise in demand for building projects from both the public and private sectors. As a result, construction projects must be handled properly and efficiently (Ugwu and Attah, 2016).

Notwithstanding the prestigious position that the construction industry holds in the country, there are instances of failed and/or failing projects brought on by a lack of skills and appropriate knowledge on the part of individuals tasked with project management (Kanyago *et al*., 2017).

According to Kanyago *et al*. (2017), the construction industry's design process is important to ensure that the developing design and budget do not diverge and are coordinated by the lead designer, the consultant team, the client, and the contractor. Moreover, project review may be undertaken to evaluate the effectiveness efficiency of the project delivery process, including assessments of how well the project delivery is performed against key performance indicators.

2.2 Overview of Construction Project Management

As defined by Liu (2020), construction project management is the appropriate planning, organization, application, coordination, monitoring, control, and reporting of the core business processes of marketing, procurement, production, administration, account, and finance that are necessary to achieve financial success and profitability for a company engaged in the provision of construction facilities. Control of a project from inception to completion to produce a fully viable solution that meets a client's goals and is both functionally and financially sustainable, according to (Wang and Li, 2020).

The true definition of a construction project is "the application of acquired academic knowledge by the professionals that comes together to developed a working drawing using the clients' briefs, execution, monitoring and control of the craftsmen, artisans, skilled and unskilled labour, materials, and machineries to achieved the three main objectives," according to a related study "on the comparison between construction projects and academic projects" (Zhang, 2020). Moreover, the process of designing, planning, supervising, controlling, and carrying out projects to achieve mutually beneficial results is referred to as construction project management (Wang and Li, 2020).

Project integration management ensures the project is correctly planned, carried out, and regulated, including the formal use of project change control. Every action must be coordinated or integrated with every other activity, as the term implies, in order to produce the intended project output. (Ouyang, 2019).

A project's "death" is frequently caused by changes to its scope. Authorizing the job is just the beginning of scope management, which also allows making a scope management that

will define the project's boundaries, breaking the work down into manageable components with deliverables, confirming that the planned amount of work has been completed, and defining the scope change control procedure. (Zhang, 2019).

2.3 Construction Project Management Planning Tools

A construction project's execution is planned and controlled by the project manager assigned by the agency or the contractor specification of project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants (Liu, 2020).

According to Shan *et al*. (2019), maximization of efficient resource utilization through procurement of labor, materials and equipment according to the prescribed schedule and plan. Also, stated that implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process. Furthermore, development of effective communications and mechanisms for resolving conflicts among the various participants. (Dziekonski, 2017).

2.3.1 Construction project time management tool

Personal efforts must be made to manage one's time. It refers to creating a schedule that can be met for construction projects and then supervising work to make sure this happens. Schedule management is another name for project time management in construction (Ouyang, 2019). Yet, this is a strong tactic, especially for white collar, management, and supervisory staff.

Time management involves minimization of wasteful elements of person's administrative work. Lack of efficient and efficient time management leads to: Interruptions by drop-in visitors (without appointment), attending lengthy and unnecessary meetings that accomplish

very little, inability to say “no” for some tasks, procrastination and lack of decisiveness, inability to delegate work, taking on much more than can be handled, lack of responsibility and authority to do certain jobs, delayed, inaccurate or inadequate information, taking orders from too many people, handling too many “crisis” situations, lack of organization of tasks by priority or target dates, lack of determination to complete tasks assigned, lack of organization on and around desk, unnecessary socialization, poor filling system, making unnecessary trips to people, departments, copy machines, excessive conversation time, and too many rescheduling of meeting, personal engagements (Shan *et al*., 2019). To minimize these “time-wasters”, time management applies simple, common-sensible but very effective programming rules to very item of work, one of which is: “never handle same task twice” (Huang *et al.,* 2019).

Employees are given freedom in determining their hours of work. The schedule of the time series can be given as:

i. Core time (hours when all employees must be at work)

ii. Flexible time (hours when employees can vary their time of arrival and departure)

Compressed Work Week: Working for same number of hours but for fewer days / week

iii. 08 hours 05 days

iv. 10 hours 04 days

This time schedule series is a concept of time management knowing when to work, the time allocated in hours for each task, and the relaxation period to cool down heels (Wang and Li, 2020).

2.3.2 Construction project cost management tool

This involves estimating the cost of resources, including people, equipment, materials, travel, and other support details. Costs are budgeted and tracked to keep the project within the budget (Zhang, 2019).

2.3.3 Construction project quality management tool

As Zhang (2019) commented, one cause of project failure is that quality is overlooked or sacrificed so that a tight deadline can be met. It is not very helpful to complete a project on time, only to discover that the thing delivered won't work properly. Quality Management included both quality assurance (planning to meet quality requirements) and quality control (steps taken to monitor results to see if they conform to requirements).

2.3.4 Construction project human resource management tool

Managing human resources is often overlooked in construction projects. It involves identifying the people needed to do the job, defining their roles, responsibilities and reporting relationships, acquiring those people and then managing them as the project is executed (Shen, 2020).

2.3.5 Construction project communication management tool

Communication management involves planning, executing and controlling the acquisition and dissemination of all information relevant to the needs of all project stakeholders. This information will include project status, accomplishments events that may affect other stakeholders or projects and so on (Shan *et al.,* 2019).

2.3.6 Construction project risk and procurement management tool

The methodical process of recognizing, evaluating, and responding to project risk is known as risk management. It involves limiting the profitability and effects of unfavorable occurrences on project goals while optimizing the profitability and effects of favorable events. Sometimes, inexperienced project managers neglect this crucial component of project management (Zhang, 2019).

Logistics refers to the components of project management that involve acquiring the goods and services required for the project. Choosing what has to be purchased, requesting quotes or bids, choosing vendors, managing contracts, and closing them after the project is complete are all included (Liu, 2020).

2.4 Construction Management Planning Tools Currently in Use in Project Delivery

Different techniques and tools are used in managing projects for a describable outcome. Some of these techniques are as follows:

i. Work Breakdown Structure
ii. Gantt Charts
iii. Line of Balance
iv. Network Analysis
v. Projects in Controlled Environments **(**PRINCE 2)
vi. Project Sensitivity Analysis
vii. Cost Benefit Analysis
viii. Graphical Evaluation and Review Technique (GERT)
ix. Programme Evaluation and Review Techniques PERT)
x. Lean Construction Management Technique
xi. Just In Time Method

xii. Monte Carlo Technique

xiii. Critical path Method

xiv. Spread sheet

xv. Benchmark Job Technique

xvi. Cost of Quality

xvii. Expert Judgement Technique

xviii. Critical Chain Project Management

xix. Waterfall Method

xx. Classic Technique.

Ayodele *et al*. (2015) also stated that, 17 project management planning tools/ techniques were analyzed in previous research based on the level of awareness and utilization such as spreadsheets, benefit/ cost analysis, WBS, expert judgment and cost of quality as part of management tools.

2.4.1 Work breakdown structure (WBS)

Deals with breaking down of the project into manageable individual components in a hierarchical structure. Such a structure defines tasks that can be completed independently of other tasks, facilitating resource allocation, assignment of responsibilities and measurement and control of project. Doskocil (2016), also observed that it is a veritable tool for defining work packages and developing and tracking the cost and schedule for the project. Work Breakdown Structure (WBS) provides a common framework for the natural development of the overall planning and control of a project and it is the basis for dividing work into definable increment from which the Statement of Work can be developed and technical, schedule cost and labour hour reporting can be established (Ibrahim and Daniel, 2020).

2.4.2 Gantt chart

This is a useful construction technique for planning and scheduling projects. It shows graphical representation of the duration of the duration of tasks against progression of time. Some methods proposed by project management experts for proper schedule control are the use of Project Management Software (Microsoft Project) using Gantt Chart or Network Diagram, and Earned Value Management (EVM). Henry Gantt, a consultant hired by the United States Army in 1917 developed the Gantt Chart to help the Army prepare for entry in World War One (Doskocil, 2016) while the United States (US) Department of Defence (DoD) developed the Earned Value Management (EVM) in the 1960s. Gantt Chart is a scheduling technique, frequently used in project management for helping to plan, coordinator and tracks various tasks identified during the planning stage of the project (Ong *et al*., 2016). The network diagram is a model designed showing activities paths, durations and critical and non-critical paths of the project, Gantt chart and network diagram are two important project management tools for effectively estimating activity timelines, critical paths, non-critical paths, and project completion date and critical paths is the most relevant for estimating the actual time required to complete a project (Doskocil, 2016). It was developed by Henry Gantt in 1915 purposely for monitoring projects progression and tracking. Gantt charts have become a common technique for representing the phases and activities of a project Work Breakdown Structure.

The Gantt chart is a popular type of bar chart that illustrates a project schedule; gantt charts illustrate the start and finish dates of the activities and summary elements of a project

(Ibrahim and Daniel, 2020). The Gantt Chart and Network Diagram are two important project management tools for effectively estimating activity timelines, critical paths, non-critical paths, and project completion date. Gantt charts were used as a visual tool to illustrate the start and finish dates of the terminal elements and summary elements of a project. The Gantt chart is the most widely used of the techniques; perceived by the Construction Industry as being the easiest and most recognizable form of programming.

2.4.3 Line of balance (LOB)

According to Shen (2020), Line of Balance (LOB) is a management control process for collecting, measuring, and presenting facts relating to time (see Schedule Control), cost, and accomplishment – all measured against a specific plan. It shows the process, status, background, timing, and phasing of the project activities, thus providing management with measuring tools. The basic concepts of LOB have since been applied in the construction industry as a planning and scheduling method and several attempts either to modify the basic LOB technique or to develop variations named differently have also been made for examples, to name a few include: velocity diagrams, the construction planning technique, the vertical production method, the linear scheduling method, time space scheduling method, and repetitive project model.

Lines of Balance diagram are techniques used in the construction industry to illustrate the planned sequence of work and to allow adjustments due to changed circumstances. There are potentially very few projects where a LOB diagram cannot be used and be of benefit (Mohaiminul, 2020). The diagrams are usually much easier to read than a detailed Gantt chart, making it a good tool for reporting purposes and for illustrating the inter-relationship between different activities. The LOB method is not simple though when dealing with a

construction project that is broken down into many activities bound by numerous and complicated relationships and other constraints.

2.4.4 Network analysis

A network analysis diagram is a model that shows activities paths, durations, and critical and non-critical paths of the project (Mohaiminul, 2020). This method is very popular in larger projects but present complications in projects of repetitive nature such as high-rise building construction, and Critical Path Method (CPM) based techniques have been criticized for their inability to model repetitive projects and the first problem is the sheer size of the network (Jing, 2019). In repetitive projects of n units, the network prepared for one unit has to be repeated n times and linked to each other; this results in a huge network that is difficult to manage.

2.4.5 Projects in controlled environments (Prince 2)

According to Vanickova (2017), Prince2 is a process-based method for effective project management which consists of 7 Themes, 7 Principles and 3 Techniques (this the author would refer to as Prince 2-773) which are used for project management globally in the private and public sectors, and private sector participants who used this method are usually global multinational corporations. According to (Karaman and Kurt, 2015; Vanickova, 2017), Prince2 is centred on the Prince 2-773 which are as follows: 7 Themes (business case, organization, quality, plans, risk, change, and Progress); 7 Principles (Continued business justification, Learning from experience, Roles and responsibilities definition, phase by phase management, engaging exceptional management style, focusing on the product/deliveries, custom fitting to project environment); and 3 Techniques (product based planning, change control, and quality review) and other aspects of the method include 7 Processes (project

conceptualization, project initialization, project direction, project monitoring and change mitigation, product delivery management, project stage boundary management, and project ending); Adaptations and 41 Activities.

Prince 2 basically describes product-based planning, change control technique and quality review technique (Kirti and Rupali, 2017). Prince 2 benefits; ensuring projects are completed in a timely manner because of its reliable, organized and structured approach to project management; improving communication within and between the project management organization, the project initiator, the Project Board, the suppliers, the stakeholders and the product users (Pawar and Mahajan, 2017).

2.4.6 Project sensitivity analysis

This is part of the tool using during the phase of construction planning and site production management, project management tools or techniques are also important to building production management practice (Haron *et al*., 2017; Osuizugbo, 2018). This analysis is to determine which variable have the most potential to affect project. Variables include task duration, success rate and costs, risks, lags between predecessors and successors, project duration, total project cost and so on. It is also useful in decision making under uncertainty and risk (Haron *et al*., 2017).

2.4.7 Cost benefit analysis (CBA)

Cost Benefit Analysis is a widely employed analytical tool in investment decision making and it aims at estimating direct and indirect costs of a specific project in relation to its benefits (Browne and Ryan, 2011). This is one of the most widely accepted and applied methods for construction management tool for large scale infrastructure in the public and private sector (Browne and Ryan, 2011; Jing, 2019). CBA is a prescriptive technique that

provides guidance on the criteria to take account in decision making, ensuring that the net aggregate benefits to society outweigh net aggregate cost and there are several methods of carrying out cost-benefit analysis of a project. These include, the Net Present Value (NPV), Internal Rate of Return (IRR), Payback period (PBP), profitability index among others (Ihum and Stephen, 2018).

2.4.8 Graphical evaluation and review technique (GERT)

This is a network analysis technique used in construction project management that allows probabilistic treatment of both network logic and activity duration estimates. It is a useful management tool for planning, coordinating and controlling complex projects (Jing, 2019). The key objective of GERT is to evaluate based on the network logic and estimated duration of the activity and derive inference about some activities that may not be performed. GERT can be used with a complimentary network analysis evaluation of activities (path) has the least amount of scheduling flexibility and therefore will most likely determine when the project can be completed (Sung, 2021).

2.4.9 Programme evaluation and review technique (PERT*)*

Program Evaluation and Review Technique (PERT) is a method used to examine the tasks in a schedule and determine a Critical Path Method variation (CPM) and also analyses the time required to complete each task and its associated dependencies to determine the minimum time to complete a project (Aribisala *et al*., 2017) and also stated that an alternative to critical path method is the PERT project planning model, which allows a range of durations to be specified for each activity, and in Program evaluation and review technique (PERT), complex projects require a series of activities, some of which must be performed sequentially and others that can be performed in parallel with other activities. This collection

of series and parallel tasks can be modelled as a network and project managers must choose a technique that compliments the style of management adopted in the organization and a single technique cannot resolve all the issues and cater to all requirements of project management (Sackey and Kim, 2019).

The most used techniques under project management include Gantt Charts and Program Evaluation Review Technique (Ibrahim and Daniel, 2020). The Program Evaluation and Review Technique (PERT) is a network model that allows for randomness in activity completion times. It has the potential to reduce both the time and cost required to complete a project. The Network Diagram In a project, an activity is a task that must be performed and an event is a milestone marking the completion of one or more activities. Before an activity can begin, all its predecessor activities must be completed. Project network models represent activities and milestones by arcs and nodes. PERT originally was an activity on arc network, in which the activities are represented on the lines and milestones on the nodes, over time, some people began to use PERT as an activity on node network (Kim *et al.*, 2016). The PERT chart may have multiple pages with many sub-tasks.

2.4.9.1 Steps in the pert planning process

Pert planning involves the following steps:

i. Identify the specific activities and milestones.

ii. Determine the proper sequence of the activities.

iii. Construct a network diagram.

iv. Estimate the time required for each activity.

v. Determine the critical path.

vi. Update the Pert chart as the project progresses. Source (Bala *et al*., 2018)

2.4.9.2 Benefits of PERT

Pert is useful because it provides the following information:

i. PERT is mainly used where the time required for completion of each of the activities is unknown.

ii. PERT technique is of planning and controlling of time.

iii. PERT are the two-network based project management method that shows and exhibit the flow and sequence of activities and events.

iv. PERT uses probabilistic model. Source (Cynthia and Aziz, 2020).

2.4.9.3 Limitations of programme evaluation and review techniques

The following are some of PERT's weaknesses:

i. The activity time estimates are somewhat subjective and depend on judgment.

ii. Even if the activity times are well-estimated, PERT assumes a beta distribution for these time estimates, but the actual distribution may be different.

iii. Even if the beta distribution assumption holds, PERT assumes that the probability distribution of the project completion time is the same as that of the critical path, because other paths can become the critical path if their associated activities are delayed, PERT consistently underestimates the expected project completion time (Cynthia and Aziz, 2020).

2.4.10 Lean construction management technique

The production system was redesigned, resources and manpower requirement was adjusted to reality on the ground, two-way communication was introduced to enhanced transparency of work flow in the site (Hamid, 2017), and aim to design a system to achieve, optimize the

project activity by activity; assuming customer value has been identified in design and production is managed throughout a project by first breaking the project into pieces, for example (design and construction), then putting those pieces in a logical sequence, estimating the time and resources required to complete each activity and therefore the project (Huang *et al.,* 2019). Also, the rationale behind lean concept is to deliver quality projects within shortest time and budget, and the development of good communication system throughout the project delivery process gives the workers courage to communicate with the project manager and solve problems as they erupt before the system standstill (Adamu and Hamid, 2016).

The strategy used is based on evaluation the effect of using lean construction techniques in terms of two measurements, researches and discussions have been carried out using lean construction applications and Last Planner System in many countries all over the world such as Nigeria (Adamu and Hamid, 2016).

2.4.11 Just in time method (JIT)

Manufacturing JIT is a method of pulling work forward from one process to the next "just-in-time", for example, when the successor process needs it, ultimately producing throughput and the benefit of manufacturing JIT is reducing work-in-process inventory, and thus working capital. Just-in-time (JIT), a lean construction technique, has been proposed to tackle the logistics challenges in Modular Integrated Construction (Carvajal-Arango *et al*., 2019) and successful implementation of JIT results in reducing inventory, wastes and procurement costs. Just –in -time can further improve the sustainability of Modular integrated Construction (MiC) by reducing inventory levels, double handling and damages to stored materials are eliminated (Francis and Thomas, 2020). Also, Goh and Goh

(2018) have utilized a discrete-event simulation model to evaluate the contribution of JIT in MiC in reducing the project's time, increasing labour productivity and enhancing process efficiency. An even greater benefit is reducing production cycle times, since materials spend less time sitting in queues waiting to be processed (Ahn *et al.*, 2017). However, the greatest benefit of manufacturing JIT is forcing reduction in flow variation, thus contributing to continuous, ongoing improvement.

According to Hammad *et al*. (2020) d**e**veloped a mixed-integral non-linear programming model that solves the job shop scheduling problem in MiC factories. Regarding logistics in MiC, Kong *et al*. (2018) have developed a mathematical model that optimizes the number of delivery batches of prefabricated components, the number of these components in each batch, and the delivery time of each batch. Hsu *et al*. (2018) have also developed a two-stage stochastic programming model that determines the optimal dispatch time, ordering quantities and transportation time of MiC modules.

2.4.12 Monte carlo technique

According to Levent and Alexander, (2020) applying monte carlo simulation is a technique used to understand the impact of risk and uncertainty in financial, project management, cost, and other forecasting models. In a Monte Carlo simulation, a random value is selected for each of the tasks, based on the range of estimates and the model is calculated based on this random value and result of the model is recorded, and the process is repeated (Gupta and Thakkar, 2018), Monte Carlo analysis technique has proved to be an efficient quantitative technique in supporting project managers in allocating deviations and monte carlo analysis was performed using primavera analysis tool. The tool was useful to check planner errors, to use risk data obtained from the research to produce a probabilistic decision graph and the

tool allow the analysis of quantitative risk data obtained from the research and its integration into the case study schedule (Khodeir and Nabawy, 2019).

2.4.13. Critical path method (CPM*)*

Critical path method can be defined as a sequence of project network activities that add up to the longest duration and it is sequence regulates the least time possible to complete the project (Cynthia and Aziz, 2020), critical path method assist in the management of projects in two different ways: The forward and backward pass. The most widely used scheduling technique in Construction Project Management is the critical path method (CPM) for scheduling, often referred to as critical path scheduling (Junwu *et al.*, 2019).

According to Cristobal (2017), a project can be said to be successful or failed depending on the planning and scheduling of the project that has been created and the project can be managed effectively or efficiently by calculating the minimum completion time for a project along with the possible start and finishes times for the project activities. Also, the network analysis on this critical path method is used to optimize the total cost of the project by accelerating or reducing the duration required to complete the project in question.

Critical Path Method provides the following benefits:

i. Provides a graphical view of the project.
ii. Predicts the time required to complete the project.
iii. Shows which activities are critical to maintaining the schedule and which are not. Source (Cynthia and Aziz, 2020).

The following is an example of a Critical Path Method network diagram: CPM Diagram Steps in CPM Project Planning

i. Specify the Individual Activities: From the work breakdown structure; a listing can be made of all the activities in the project. This listing can be used as the basis for adding sequence and duration information in later steps.

ii. Determine the Sequence of the Activities: Some activities are dependent on the completion of others. A listing of the immediate predecessors of each activity is useful for constructing the CPM network diagram.

iii. Draw the Network Diagram: Once the activities and their sequencing have been defined, the CPM diagram can be drawn. CPM originally was developed as an activity on node (AON) network, but some project planners prefer to specify the activities on the arcs.

iv. Estimate Activity Completion Time: The time required to complete each activity can be estimated using past experience or the estimates of knowledgeable persons. CPM is a deterministic model that does not consider variation in the completion time, so only one number is used for an activity's time estimate.

v. Identify the Critical Path: The critical path is the longest-duration path through the network. The significance of the critical path is that the activities that lie on it cannot be delayed without delaying the project. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

The critical path can be identified by determining the following four parameters for each activity:

i. ES - Earliest start time: the earliest time at which the activity can start given that its precedent activities must be completed first.

ii. EF - Earliest finish time: equal to the earliest start time for the activity plus the time required for completing the activity.

iii. LF - latest finish time: The latest time at which the activity can be completed without delaying the project.

iv. LS - latest start time: Equal to the latest finish time minus the time required to complete the activity. The critical path is the path through the project network in which none of the activities have slack, that is, the path for which ES=LS and EF=LF for all activities in the path. A delay in the critical path delays the project.

v. Update Critical Path Method Diagram: As the project progresses, the actual task completion times will be known and the network diagram can be updated to include this information. A new critical path may emerge, and structural changes may be made in the network if project requirements change (Ganistian, 2021).

2.4.13.1 Critical path method limitations

Critical Path Method was developed for complex but fairly routine projects with minimal uncertainty in the project completion times. For less routine projects, there is more uncertainty in the completion times, which limits the usefulness of the deterministic critical path method model (Bagshaw, 2021).

2.4.14 Spreadsheets

Spreadsheets are common computerized tools which can provide data needed for cost estimating, cost budgeting and cost control, also used to track costs and schedules, as soon as the project schedule is optimized, the obtained output data will be processed by Project Management Software (PMS) in which their graphical representation and control during project execution can be performed, and most PMS are capable of importing spreadsheets

but only in a specific data arrangement (Ayodele *et al.*, 2015). Excel programming capabilities, Visual Basic (VBA), are generated into project management software, VBA programming language is implemented to create a new spreadsheet that can be recognized by Microsoft Project and new spreadsheet should contain columns with the following information about project activities for input recognition: ID, name, duration, predecessors and costs (Valenko and Klansek, 2017).

2.4.15 Benchmark job technique

Benchmark job technique is also known as Comparative or analogous estimating, is an estimating technique which uses historic data from similar project to determine the most appropriate cost and time and uses the values of parameters such as scope, cost, budget, and duration, or measures of scale such as size, weight and complexity from a previous, similar activity as the basis for estimating the same parameter or measure for a future activity (Ayodele *et al*., 2015).

2.4.16 Cost of quality

It refers to the total cost of all efforts to achieve product or service quality, and includes all work to ensure conformance to requirements as well as all work resulting from nonconformance to requirements. There are three types of costs that are incurred: prevention costs, appraisal costs, and failure costs, where the latter is broken down into internal and external cost and it is important to note that the project owner's satisfaction that is closely linked with the project quality forms the fundamental aim of all projects (Idiake *et al*., 2015).

2.4.17 Expert judgment technique

This refers to judgment provided based upon expertise in an application area, knowledge area, discipline, industry as appropriate for the activity being performed, and such expertise

will be provided by any group or person with specialized education, knowledge, skill, experience, or training, and is available from many sources, including other units within the performing organization; consultants; stakeholders, including customers; professional and technical associations and industry groups. For example, project team members or other experts who are experienced and skilled in developing detailed project scope statements and project schedules can provide expertise in defining activities (Ayodele *et al*., 2015).

2.4.18 Critical chain project management

A project management methodology called critical chain project management (CCPM) enables you to prioritize dependent tasks, keep track of key resources, and complete projects as quickly as feasible. Critical chain project management is a useful tool for keeping track of resources if your team wants to closely monitor how they are being used. A critical chain is composed primarily of three components: the critical path, the feeding chain, and resource buffers.

2.4.18.1 The crucial path

The critical route is the lengthiest chain of interdependent tasks that must occur in order to finish a project. In other words, it's every task that must be accomplished in order for a project to succeed, listed in that sequence. It's crucial to comprehend that there are several levels of interdependence while using the critical chain technique. The critical path, also known as the project critical path, has the highest degree of dependencies or project critical tasks. If a job has no bearing on the critical path, it is transferred to a separate path, also known as the feeding chain.

2.4.18.2 The feeding chain

A supplementary chain of interdependent tasks that must go simultaneously with the critical path is known as the feeding chain. The critical path finally combines with each feeding chain. This is so because just one of the jobs on the critical path is impacted by the series of events in the feeding chain. To avoid any delays on the critical path, the feeding chain must operate concurrently with the critical path.

2.4.18.3 Resource buffers

To guarantee a project goes well, buffers are safety measures incorporated into the crucial chain's resources. These buffers, like bumpers in a bowling alley, are intended to provide projects with more leeway in the event that anything doesn't go as planned. Three different types of buffers are frequently applied in the critical chain project management methodology:

i. Project buffers: The extra time that's placed between the final task and the end of the project. Adding an extra chunk of time before the expected due date gives team members a chance to catch up on any outstanding project tasks they couldn’t get to earlier.

ii. Feeding buffers: The extra time that's placed between the feeding chain (also known as the non-critical chain) and the critical chain. Adding this buffer into the timeline prevents any delays from the feeding chain affecting the critical chain.

iii. Resource buffers: These are literal resources you set aside in case the critical chain needs extra supplies—like extra team members to have on hand, additional equipment, or help from a third-party (Laoyan, 2022).

2.4.19 Waterfall method

The most popular type of construction project management methodology is waterfall project management. This approach, sometimes referred to as classic project management, places distinct milestones between each work. Deliverables, deadlines, and client expectations are all structured on a timetable with clear due dates. Waterfall employs a methodical approach; you can't construct a bathroom in a house without first constructing the structure itself. Simply put, traditional project management should be taken into consideration if your project is sequential.

When referring to a particular workflow process, the phrase "waterfall" is most frequently used in the IT industry during software development. It is frequently referred to as "conventional" project management and is quite popular in the building sector (Burger, 2016).

2.4.20 Classic technique

In order to achieve tangible results, we frequently believe that completing a project or assignment in our professional lives necessitates the use of the most sophisticated tools and techniques. While this is generally true, there are times when using more conventional methods will result in more successful project development.

The classic project management method is an amazing process that includes a proper plan to cover all upcoming work activities, which tasks are to be performed, and what should be the chain of application that defines which task to do first. It also involves allocating adequate resources to the tasks in accordance with their importance, giving and receiving proper feedback from the team to help with team building, and monitoring the quality of the work done and how it is being used (Wilson, 2019).

2.5 Level of Implementation of Construction Management Planning Tools

The level implementation of the construction management techniques in construction organisations in Nigeria (Abuja) were found to be faced with the challenge of poor implementation management tools and also the inability to effectively carry out the construction management techniques in the execution projects (Ibrahim and Daniel, 2020). Poor planning in the management of projects was evident in the inability of the construction firms to implement the tools, Such as Work Breakdown Structure, Gantt Charts, Projects in Controlled Environments **(**PRINCE 2), Critical path Networks, Programme Evaluation and Review Techniques, Project Sensitivity Analysis, Cost Benefit Analysis, Graphical Evaluation and Review Technique (GERT) and Construction Project Software (Ugonna and Ochieng, 2018).

Ugonna and Ochieng (2018) stated that the level of implementation of construction management techniques activities is to enable project managers achieve their strategic project objectives; project managers of construction organisations need to pay attention to planning at the early stage of the project and project risk, which was found to be inadequate and implementation of the plan. Also, as stated by Liu *et al*. (2019) the construction management tool is implemented in both private and public construction firms, but not inadequate. The Programme Evaluation Review Technique (PERT) and the Critical Path Method (CPM) are techniques widely used to manage project circles and activities from conception to the close of the project, these tools are adequately utilized in Nigeria for the optimization of project duration, time minimization and project efficiency.

Ayodele *et al*. (2015) stated that, 17 project management planning tools/ techniques were analysed in previous research based on the level of awareness and utilization, the result of

the research analysis indicated that the basic project management planning tools/ techniques such as spreadsheets, benefit/ cost analysis, WBS, expert judgment and cost of quality, has the highest awareness and use both in the government representative organizations and in private consultancy firms, also, an increasing awareness of project management planning tools/ techniques was observed and that has also led to an increase in the adequate use of project management planning tools/ techniques.

For successful project management, it is important that all project activities are performed within a deadline, which means that the financial plan is set in accordance with the estimated budget as well as that the project beneficiaries are satisfied with project implementation and benefits derived from it (Ayodele *et al*., 2015). Therefore, as stated in previous researches that the level of implementation of construction management techniques review will be in terms of adequate used of tools, inadequate use of tools, and no use of tool in construction firms in Nigeria (Abuja) by project managers.

2.6 Barriers to the use of Construction Management Planning Tools

Shan *et al.* (2019) asserted that risk management, poor communication, unrealistic expectations, delay cash flow are barrier to effective implementation of construction management techniques. In line with this, Karim (2016), also stated that undefined goal, changing scope, no accountability, stakeholder indifference, over utilization of mismanagement of resources, implementing wrong tools for completing a task are barrier to effective implementation of construction management techniques which is also agreed by (Phillips *et al.,* 2018). There are many potential pitfalls in the life of a construction project, project managers are tasked with keeping a site running smoothly, safely, within schedule

and on budget and sometimes, this is a very difficult task according to (Kissi *et al.*, 2016), 98% of construction projects come in over-budget and 77% of them suffer significant delays. Inadequate risk management occurs when project managers put safeguards in place for long-term risk, short-term issues, often left out of the equation (Shan *et al*., 2019). These issues can snowball quickly and start to have a real impact on the bottom line. Whether it's subcontractors that turn out to be unreliable, scheduling conflicts, or the changing tastes of stakeholders, any seemingly small issue could derail a project. Therefore, it's important to have contingency plans. Build some wiggle room into schedules, and invest in programs like safety training to avoid any potential issues. According to Padalkar and Gopinath (2016), risk management is important in construction as the risks are greater, and far more expensive than ever, one of the challenges in construction project management is managing risk, since the project manager is responsible for identifying potential problems and finding ways to mitigate it. They need to gather input and plan ways to prevent the project from veering off course. Without this, the project will most certainly go over budget or delayed.

Human resources goal (staff recruitment issues, team work, virtual teams, cultural challenges, labour related challenges, cross cultural leadership skills and transformation leadership). Without clear goals, it's difficult to get things done in an efficient manner, and construction project can easily fall behind or run over budget (or both) if people don't have a clear target they need to hit, and without these goals, it's difficult to hold people accountable for their part in a project (Padalkar and Gopinath, 2016). Khanh and Kim (2016) also asserted that project definition and planning contribute to barrier of use of tools to plan (bad planning, Project scope management and project location).

Khanh and Kim (2016) also stated that Performance management, knowledge management, stakeholder management, are key aspect of project management barrier, and in order to implement these and keep everyone on task, they all need clear tasks to perform, break down bigger, project-wide goals into smaller, daily targets for individuals to accomplish.

Communication management, procurement management, cost management are also important barrier in management tool in construction management, but it's especially important when work is delegated amongst various parties, without clear and effective communicating, important tasks can slip through the cracks and the team can remain unaware of an issue until it's too late to rectify (Padalkar and Gopinath, 2016). Therefore, project managers need to enact clear guidelines and communication gap between teams on any progress at the end of each day, this way, problems will be solved proactively, if in-person meetings are not an option, using different types of software could be an excellent solution as agreed by (Padalkar and Gopinath, 2016).

Suwandej (2016) also stated that, quality management is one of the challenges to effective implementation of construction management techniques which are plan quality management; perform quality assurance, measurement of metrics, regulation and traceability. The project manager has to foster quality management plan in construction project management**.** Implementing the wrong tool for completing a task occurs in many organizations using local software to manage the work done under project management. This leads to poor quality management as agreed by (Phillips *et al*., 2018). Thus, it is highly important that the project manager is aware of sophisticated and advanced technologies tools and should be integrated to ensure desired outcome, if wrong or obsolete tools are implemented, the entire purpose of implementing project management goes waste, therefore

the project manager has to foster quality management plan in construction project management (Phillips *et al*., 2018).

Stakeholder management (Unrealistic Expectations/Bad Forecasting some clients) may make some big tasks, whether they want a project completed on an accelerated schedule or on a limited budget, there may be some challenges that come with their expectations and while some things are possible for a skilled project manager, some things simply different (Tabassi *et al.*, 2017). Also, working with unachievable goals can actually hinder productivity; why exhaust yourself working overtime, some of these expectations are set due to bad forecasting, and it could be much like risk management, focuses on the long-term instead of the short-term, break those forecasts down into monthly, weekly, and daily goals to see if they are actually achievable (Padalkar and Gopinath 2016; Tabassi, 2017). Suresh *et al.* (2017) also stated that project managers face cost management challenges when implementing construction management tools in cost estimation; cost monitoring and controlling, value analysis and life cycle cost of building.

Delayed cash flow in construction business relies on invoicing, and if payments fall behind, it could negatively impact a construction company, this can in turn dry up a well of funds for other projects and cause delays, therefore, systems of invoicing need to evolve with improved software and ensure that cash flow does not affect other projects negatively (Okere, 2017). Poor planning, bad management, lack of experience, misuse of resources, passive participation, and misuse of time are also part of the barrier project manager when implementing management tools on construction project as described by (Afolabi *et al*., 2017).

Another way of overcoming conflict and dispute management challenges is by developing project culture, so that the organization is capable of responding quickly to challenging situations the teams and their tasks Tabassi *et al*. (2017). Project culture helps and also contributes towards effective project management and the concept of project culture consists to three main elements: organizational structure of the project to support the aspects of success in the project, the processes, methodology, tools, related to project management implemented in the organization and the project management competence (Kim *et al.*, 2016).

2.7 Drivers to Construction Management Planning Tools.

Othman *et al.* (2019), also noted that the prevailing trend towards economic growth in developing countries has resulted in a huge demand for delivering construction projects, and six key drivers that foster effective implementation of construction management techniques in Abuja are: to improve greater efficiency, to manage complex projects, to reduce cost overruns, to reduce delays, to reduce disputes and to improve project success (proper understanding and Management methodology and practice).

Oke and Aigbavboa (2017), noted that a crucial driver to be considered in the promotion of any new concept is through training and education management of concerned stakeholders on the basics, techniques and benefits of the concept. It is therefore necessary to ensure that the curricula of higher institutions offering construction-related courses are updated to include these drivers of construction management concepts and other emerging ones. Oke and Aigbavboa (2017) further suggested that, to effectively drive the implementation of CMT in the construction industry, this practice should form part of the competencies, duties and required skills for members of professional bodies within the industry and various workshops, seminars, conferences and trainings, organised for the professional development

of existing members, should include CM practice and guidelines on how they can be practically adopted for construction projects.

Oke and Aigbavboa (2017), suggested the need for usage of electronic construction management approach in improving exercises in construction industries worldwide, described this approach as the use of technological advances such as video conferencing, and the like, to create a new construction management delivery process that differs significantly from the traditional physical team workshop and the management team works over the internet and make use of the latest technology for the exercise. Karim (2016) also advised that the top management of construction organizations must also be ready to adopt this approach as part of their organizational culture. It should be nurtured as a culture within construction industry to realise its indispensable transformation**.**

Sabiu and Agarwal (2016), also noted that achieving a client's commitment and involvement is part of the key driver of construction management in most cases, client dreams needs to come to reality, and this has led to satisfaction of clients in the construction industry, the failed attempts to remedy this situation satisfaction by the industry have led to the recommendation of the adoption of client's value system (client commitment and involvement). Kissi *et al*. (2016), also suggested government involvement through introduction of management policy, regulations and guidelines will boost the construction industry in Nigeria (Abuja).

The need for societal awareness of it benefits and application guidelines for the implementation of the practice to be made available to stakeholders in the construction industry, including clients and professional bodies and he further stated that these approach will also increase the level of training and education for managers and frontline employees

alike and the development of technical staff if establishment of groups support system on construction management is also employed (Kim *et al*., 2016; Kissi *et al*., 2016).

2.8 Strategies for Implementation of Construction Management Planning Tools

According to Guribie and Tengan (2019), Strategies can be defined as any action executed to implement an organisation's corporate strategy and any step taken to achieve one of the organization's future goals. Strategies in construction management can also be described as the method in which all organizational resources are aligned, implemented and co-ordinated to work with the particular business environment (Guribie and Tengan, 2019). The systems and procedures required for the implementation of strategies in construction management processes depend largely on the nature of the construction industry in which the organization is operating, as well as the knowledge of higher-level management techniques in the industry (Dang and Le-Hoai, 2019). The projects of different field have a common characteristic and their ideas as well as activities are entering in new endeavors and most construction firms strive to deliver their strategies through Project, Programme and Portfolio's (P3M), therefore; it is important to understand the processes, tools and techniques that are used to achieve this and every stage of the research process is grounded on suppositions about the foundation and the nature of the knowledge (Abu-Adi *et al*., 2021).

Okere (2017), stated that formulation phase is also known as the planning phase, or the strategic planning process. It involves three key tasks, namely organizing, leading and control. There are three levels of construction management within an organisation: top, middle and operational and each of the levels has its own responsibilities relevant to strategies.

Almarshoudi *et al.* (2018), also suggested turnaround strategy are very common and popular in South Africa and type of strategy is pursued when the construction industry, in which an organization operates, experiences an economic downturn; the entity must then make an effort to save itself. Generic strategies are not functional strategies during times when construction industry is in a decline and great deal of information has been produced within the corporate strategy field, but not sufficiently to have any significant impact on the industry as a whole and during an economic decline, construction firms consider alternatives in order to deal with any rapid changes in the environment (Rangel-Buitrago, 2020).

According to Ding *et al.* (2018), the implementation strategies need to be developed and executed by every individual within construction firm; in doing so, all the employees develop a sense of belonging and increased levels of motivation and also state that: "Strategies does not belong only to an elite group at the top of an organization". The best way of survival is to adapt effectively to construction industry, after the achievement of the strategy in the short and long term, the teams need to implement the plans as quickly and as effectively as possible as also agreed by (Okere, 2017). The various strategies for implementing construction management techniques are:

i. Guidance / guideline on the use of modern technology.
ii. Integrate modern techniques with building regulations.
iii. Wider publicity for generating public awareness.
iv. Education and training within companies.
v. Industry academia collaboration on training.
vi. Government support to ensure finance and insurance.
vii. Collaboration / partnering between key parties. Source (Ajugiya *et al.*, 2017).

Therefore, Sela (2020), also cited the following construction strategies that help reduce inefficiencies and improve profits.

i. Implementing project management software

ii. Articulating a clear set of values and targets

iii. Basing construction plans around data

iv. Including training programs in operations

v. Determining appropriate Key Performance Indicators (KPIs)

vi. Regulating profitability and track costs

Afolabi *et al*. (2017), also recommended strategies for implementation of construction management tool for project success and in addition, National Associations and the Regulatory bodies involved in construction practice should have regular workshops to educate team members and monthly inspection of on-going projects to ensure high standards are met by the professionals and government supervision on setting standard and enforcing of standard setting to be practiced, therefore, government should enact construction management policies which promote standards, implementation and ensures that erring professionals are penalized.

The various strategies implemented for effective delivery of project are;

i. Monthly regulatory body inspection to ensure practice.

ii. Government supervision on setting standard.

iii. Enforcing of standard setting to be practiced.

iv. Ensuring of documented procedure to be used as reference.

v. Transfer of construction management techniques from other field profession.

vi. Early detailed course on construction management for early awareness.

2.9 Project Delivery

Project delivery can be viewed as delivered the project in the right way by managing the three project constraints such as time; cost and scope of work as described by project design (Samuel *et al.,* 2019). Project success can be defined as meeting goals and objectives as prescribed in the project plan and successful project means declared budget, schedule, quality, clients' satisfaction, project team (people and organisational), tools and techniques, health, safety and environment as the criteria for measuring construction project success (Samuel *et al.*, 2019).

According to Zidane and Olsson (2017), Project delivery is measured by project efficiency and project effectiveness, defines project efficiency as the production of an output in a qualified and competent way in terms of the agreed cost, time, quality, health and safety where quality is not a constraint per second but is often a by-product of the other three factors (scope, time and cost) and efficiency is more about comparing the outputs of the project to its inputs and in this study, project efficiency is measured in the development of construction projects by project cost and project schedule. He also added that effectiveness can be related to doing the right things and it is an external type of measurement and is focused on how the construction process contributes to increased value for the owners and users, and is measure in the development of construction projects by customer satisfaction and the overall project performance.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

As stated by Bostley (2019), research design refers to the method of changing a research idea into a research plan, which can be carried out in practice by a researcher. It also involves several considerations, from the use of research methods, to data collection and analysis. The research method could be qualitative, quantitative or a combination of the two, known as the triangulation/mixed methods (Danku *et al.,* 2020). The research design employed in this study was descriptive statistics. An exposition was made on the data sources, data collection method, sampling and sampling techniques, research instrument and data analysis method for this research work.

3.2 Research Method

The research method is a logical research process involving making necessary philosophical assumptions and values (Morenikeji, 2006). It examines the assumptions, overarching ideas, and research techniques employed in a particular study area. The types of problems that are worth looking into, what constitutes a researchable problem, how to frame a problem so that it can be investigated using particular designs and procedures, and how to select and create suitable data collection methods are all covered in methodologies (Teddlie and Tashakkori, 2009). Method of research choice is divided into two distinct roles: mono method and multiple methods (Saunders *et al*., 2016). While the multiple techniques are divided into multi method and mixed methods, the mono method is divided into quantitative and qualitative categories (Allison and Smith, 2017). Based on the nature of this research, the mixed method was adopted to achieve the aim of the study.

3.3 Research Population

According to Alex (2021), research population is a complete set of elements (persons or objects) that possess some common and distinct characteristic, according to the sampling criteria identified by the researcher. The study population for this study shall comprise some construction firms and the professionals are respondent picked from the firms that are in active practices in the study area. The professionals will include Architects, Quantity Surveyors, Engineers, and Builders. Information about the professionals will be obtained from the register of their various professional bodies to find out the list of those registered with their professional bodies. The list will form the basis for consultation and selection of sample for this study.

3.4 Sample frame

Sampling frame is a pool from which the expected sample is to be generated (Albert *et al*., 2020). If the source list is unavailable, the researcher is expected to develop the list to be reliable, comprehensive, appropriate and correct while ensuring that it represents the population as much as possible (Albert *et al.*, 2020). Preliminary findings show 113 registered professionals' responses (CORBON, COREN, ARCON, QSRBON) from the random list of firms (government and private) where registered professionals can be found in Abuja and were considered for this study.

3.5 Sample size

One of the objectives of sampling in construction industry in selecting a statistically representative sample from the population of interest such that the inferences and study findings from the sample represent real associations in the population of interest, the sample size of a research study should have adequate power and significance according to (Majid *et*

al., 2018) The total sample size for this study is 184 professionals that the researcher was able to access. Out of the 113 responses were retrieved and 100 responses was considered for analytical purposes.

3.6 Sampling Technique

The two main extremes of the sampling technique are the probability and the non-probability sampling. Probability sampling types are sample random, stratified random, cluster, and multi stage sampling, and probability sampling require that every member of the population has a known and non-zero chance of being selected in the sample (Turner and Houle, 2019). In this research on the assessment of implementation of construction management planning tools in project delivery in Abuja, probability random sampling is an effective approach to ensure the research targets the right population.

Professionals in construction firms in Abuja are the primary target for this research since they are more likely to have relevant knowledge and experience in implementation of construction management planning tools and construction projects. In order to guarantee equal representation for each of the identified groups of professionals in the population, random sampling method will be adopted for the research (Shrout and Rodgers, 2018). The respondents will be first categorized into different strata/groups: project managers, builders, quantity surveyors, architects and engineers before they will be selected and probability randomly sampled accordingly.

3.7 Method of Data Collection

The instrument used for data collection is a well-structured questionnaire that was created in response to the research topics in this study after reviewing relevant literature. A questionnaire survey evaluates a known population's opinions, beliefs, actions, attitudes, and

knowledge regarding a topic or issue (Turner and Houle, 2018). According to Vasantha and Harinarayana (2016), web-based survey are now common data collection instrument in an internet environment, advantages includes simplicity of design, development and obtaining of responses. The questionnaire was developed using Google forms consists of several questions in a definite order on a set of forms and is shared with the respondents in Abuja, which is part of the online survey tool fast gaining in the academia and other environment.

The questionnaire was structured based on the research objectives with the view to provide data for analysis. A well-structured questionnaire was formulated from the review of related literature and based on the seven-point Likert-scale quantification. The Likert scale can determine the attitudes of respondents about their feelings on various situations (Bamgbade *et al.,* 2019). Similarly, the Likert scales are ideal for defining respondents' thoughts on various statements (Wahyuni, 2016). That is the scale of 7 (strongly disagree) 6 (disagree) 5 (more or less disagree) 4 (undecided) 3 (more or less agree) 2 (agree) to 1 (strongly agree).

The screening criterion to select a valid response that is fit for analysis was based on two (2) factors, firstly, any questionnaire with unanswered questions is not considered, and if the respondent provides more than one answer to the same question. Any questionnaire that falls under the listed categories was deemed unfit for analysis. Hence, all the questionnaires were administered to various professionals in selected construction firms in Abuja, of which 113 responses were retrieved and 100 suitable used for this analysis.

3.8 Method of Data Analysis

The conclusions of this study were derived through an analysis of all the data gathered from the questionnaires. The Statistical Package for Social Science version 26 was used to carry out factor analysis, mean score (MS), multiple regression and one-way ANOVA (Kruskal-

Wallis) on the primary and content analysis was used to analyse the interview. To ensure clarity, the results were displayed in tables and charts.

3.9 Reliability and Validity Test

3.9.1 Validation of the study

The questionnaire administered for this research work by the researcher were validated to ensure that they are clear as well as extensive, free of ambiguity, and that the respondents understand the study. The researcher made extensive consultation with friends, academic and professional colleagues and most importantly the supervisors of this study to validate the questionnaire through their input; some of the initial statements under were removed and new ones added and other readjusted to ensure validity of the study.

3.9.2 Reliability of the Study

Taking into consideration the latent oddity of the variables measured in the study, multi-item, 7- point Likert-type scales were used (1=strongly disagree and strongly agree), for Barriers to the implementation of construction management tools as well as strategies for the implementation of construction management tools for project delivery. 7-point Likert scale was adopted as against 5-point Likert scale in accordance with Taherdoost (2019), who stated that data from Likert scale becomes significantly less accurate when the number of scale points drops below 5 or above 7. A reliability test was carried out using SPSS version 21. The Cronbach's alpha values which denote the reliability of the scales was examined. The Cronbach's alpha for barriers construct is 0.982 and for strategies is 0.920 this is above the threshold of 0.7 (Kang *et al.,* 2015) meaning that the data is reliable showing a strong internal consistency and a high degree of co-variance (Chew *et al.*, 2008).

Table 3.1: Data collection methods and analyses adopted

	Objectives	Data collection	Method of Analysis
1	To identify construction management techniques (Tools) in place for project delivery. Abuja.	Structured questionnaire only	Factor Analysis Ranking
2	To assess the level of implementation and effectiveness of construction management techniques in the construction industry in Abuja.	Qualitative (Structured interview)	Content Analysis
3	To identify barriers to effective implementation of construction management techniques in the construction industry in Abuja.	Quantitative (Structured questionnaire only)	Mean Score Ranking
4	To examine the drivers of construction management techniques in the construction industry in Abuja.	Qualitative (Structured interviews)	Content Analysis
5	To determine strategies for the implementation of construction management techniques for effective project delivery in the construction industry in Abuja.	Qualitative Quantitative	Multiple Regression analysis Mean Score Ranking Content Analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Characteristics of Respondents

Descriptive statistic is very important as it gives a good overview of the kind of data the researcher has gotten for analysis to adequately meet the research objectives. The questionnaire administered is made up of 5 Sections on 7 Likert scale. The questionnaires were administered to various professionals in selected construction firms in Abuja, out of which 113 responses were retrieved and 100 suitable used for this analysis. The characteristics of respondents is summarised in Table 4.1. The table shows the nature of organization, size of organisation, gender, profession, age, years of experience, academic qualification and professional qualification.

From the table it shows that there are more private construction firms (contractors) in Abuja with 72% while government owned construction organisations is made up of 28% of the respondent. Size of employees: Looking at the size of construction firms in Abuja in term of number of employees, 1-10 were 27%, 10-50 were 21%, 50-100 were 19% and over 100 were 33%. Most of these companies employed workers more than 100 showing that construction firms employed a large number of people, taking a position as a large employer of labour within Abuja and across the nation. Size of organisation: Categorising the size under small, medium and large companies, 23% of the respondents classified their firm as small, 38% as medium and 37% as Large while 2% did not indicate their responses.

Gender: A close observation at gender of the respondent shows that 98% were male while 2% were female, which means that the industry is still a heavily male dominated industry.

This is in line with other researchers' findings that the construction industry is a male dominated one (Odubiyi, 2018). In the opinion of Ojelabi and Nnebue (2022), they stated that women were underrepresented in the Nigerian construction industry and it calls for serious concern. Professionals: Among the professionals that responded to the questionnaire administered, Project Manager were 16%, Builder were 32%, Quantity Surveyor were 15% Architect 13% and engineer with 24% Builders ranked highest with 32% showing the growing influence of builders in Abuja construction Industry, this is followed by engineers with 24% and the lowest is architect.

Age group: The age range 26-35 years were 28%, 36-40years were 50%, 46-50years 10% and over 50 were 12%. The age range of 36-45 years takes 50% of the respondents showing matured age range of professionals this was followed by younger age range of 26-35. The rest comprises older age that play supervisory and managerial roles. Years of Experience: On the year of experience of the respondents, 0-5years were 11%, 6-10 years were 26%, 10-15years were 37% 15-20 years were 13% and over 20years were 12% with 1% of the respondent without responding. The age range of 10-15 years has the highest percentage of 37% followed by 1-10 years of experience which is 26%, this shows an experienced professionals on Abuja construction sites.

Academic qualification: Academic qualifications of the respondents shows ND were 2%, HND were 13%, BSc/BTech/BEng were 42%, MSc/MTech/MEng were 38%, PhD were 3% with 2% without responses. This shows highly academically qualified professionals, with the first degree taking the highest percentage of 42% and 38% of second degree. This shows a high level of academic attainment of professionals in selected construction firms in Abuja. Professional qualification: CORBON were 34%, COREN were 21%, ARCON were 10%,

QSRBON were 17%, while 5% did not possess any professional qualification and 13% of missing value. Most of the respondents were equally professionally qualified with CORBON registered builders at 37.9% followed by COREN at 24.1%.

Table 4.1: Characteristics of Respondents

Variable		Frequency	Valid %	Cumulative Percentage
Nature of Organisation	Public	28	28	28
	Private	72	72	100
	Total	**100**	**100**	
Size of Firm (Employee)	1-100	27	27	27
	10-50	21	21	48
	50-100	19	19	67
	>100	33	33	100
	Total	**100**	**100**	
Size of Organisation	Small	23	23	23
	Medium	38	38	61
	Large	37	37	98
	Missing	2	2	100
	Total	**100**	**100**	
Gender	Male	98	98	98
	Female	2	2	100
	Total	**100**	**100**	
Profession	Project Manager	16	16	16
	Builder	32	32	48
	Quantity surveyor	15	15	63
	Architect	13	13	76
	Engineer	24	24	100
	Total	**100**	**100**	
Age	26-35	28	28	28
	36-45	50	50	78
	46-50	10	10	88

	>50	12	12	
100				
	Total	**100**	**100**	
Years of Experience	0-5	11	11	11
	6-10	26	26	37
	10-15	37	37	74
	15-20	13	13	87
	>20	12	12	100
	NR	1	1	
	Total	**100**	**100**	
Academic Qualification	National Diploma	2	2	2
	Higher National Diploma	13	13	16
	BSc/BTech/BEng	42	42	57
	MSc/MTech/Meng	38	38	95
	PhD	3	3	98
	NR	2	2	100
	Total	**100**	**100**	
Professional Qualification	CORBON	34	34	39.1
	COREN	21	21	63.2
	ARCON	10	10	74.7
	QSRBON	17	17	94.3
	NR	5	5	100
	M	13	13	
	Total	**100**	**100**	

4.2 Construction Management Planning Tools Currently in Use in Project Delivery in Abuja

The construction management planning tools in use for project delivery in Abuja were identified. The data were collected with the aid of a structured questionnaire only and the analysis was done using factor analysis. The various construction management planning tools were coded for easy analysis. From the responses it is obvious that construction management tools are very much in use among construction firms in Abuja.

The data was subjected to factor analysis to identify the construction tools and access its suitability for factor analysis. This test is used to evaluate the variance proportion among all

the variables. The variance proportion can be divided into 2, the KMO value >0.5 is acceptable while the value <0.5 is not acceptable for factor analysis (Reddy and Kulshrestha, 2019). In Table 4.2, the value of the KMO is 0.724 which is greater than 0.5, however, the higher the value is as it approaches 1 the better its suitability for analysis, therefore it is acceptable for further factor analysis.

The Table 4.2, The Approx. Chi-Square value obtained is 636.408. The significance value p of the Bartlett's Test of Sphericity is 0.000 and it is less than 0.001. Thus, the correlation matrix is not an identity matrix. This indicates that there is relationship strength amongst the variables. Thus, factor analysis is applicable for this set of data

Table 4.2: KMO and Bartlett's Test to Identify Construction planning tools

Kaiser-Meyer-Olkin Measure of Sampling Adequacy. .725	
Bartlett's Test of Sphericity 636.408	Approx. Chi-Square
190	df
000	Sig

4.2.1 Factor analyses to identify construction management planning tools

Factor analysis was used to rank the listed construction management planning tools and the communalities can be seen in Table 4.3. the following deductions were made: the extracted factor for 68.3% of the variance for Work Breakdown (WB), 72.9% for Gantt Chart (GC), 59.3% for Line of Balance (LOB), 67.8% for Network Analysis (NA), 43.8% for Prince 2 (P2), 63.1% for Project Sensitivity Analysis (PSA), 74.1% for Cost Benefit Analysis (CBA), 77.1% for Graphical Evaluation and Review Technique (GERT), 67.5% for Programme Evaluation and Review Technique (PERT), 61.0% for Lean Construction Management

(LCM), 56.4% for Just In Time (JIT), 68.4% for Monte Carlo Technique (MCT), 24.6% for Critical Path Method (CPM), 47.9% for Spread Sheet (SS), 68.6% for Cost Of Quality (COQ), 68.6% for Benchmark Job Technique (BJT), 54.2% for Expert Judgement Technique (EJT), 43.3% for Critical Chain Project Management (CCPM), 74.2% for Waterfall Method (WM), 82.0% for Classical Technique (CT). According to Reddy and Kulshrestha, (2019) any variable less than 0.5 should be discarded, from the table variable CPM, SS, CCPM, P2 were less than 0.5, this shows that they were less used within Abuja construction industry which those extraction greater than 0.5 were those used within the construction industry in Abuja. Generally, all the tools are identified with from the respondents showing that they are very much in use within the construction industry in Abuja with the ranking from the factor analysis communalities ranked CT as the highest followed by GERT, WM

Table 4.3 Construction management planning tools

Construction management planning tools (Code)	Initial	Extraction
WB	1	0.683
GC	1	0.729
LOB	1	0.593
NA	1	0.678
PSA	1	0.631
CBA	1	0.741
GERT	1	0.771
PERT	1	0.675
LCM	1	0.610
JIT	1	0.564
MCT	1	0.684
COQ	1	0.686
BJT	1	0.686
EJT	1	0.542
WM	1	0.742
CT	1	0.820

4.3 Level of Implementation of Construction Management Planning Tools

In order to assess the level of Implementation and effectiveness of construction management planning tools in construction firms in Abuja, structured interview was carried out, it was discovered that many of the firm implemented construction management tools in their operation. Ten professionals were interviewed from construction firms in Abuja and nine are using construction management tools while only 1 did not. Those that are using these tools listed the following as the ones they are using on their site: Network Analysis, Work Breakdown, Gantt Chart, Cost Analysis Spread sheet, critical path, PERT, GERT, Prince2, Just In Time and these were already captured in the List of construction management tools considered for this research work. 4 of the construction management tools stands out among the list of those used, they are Work breakdown, Critical Path, Network Analysis, Gantt Chart.

4 of the professionals proficient in these tools at expert level, 4 at advance level, 1 moderate and 1 beginner. 9 of the professionals said the implementation of these tools was effective. Those using construction management tools sees a lot of advantages of using these tools compared to not using it. The general remark is that the implementation of these tools makes their work better assessing its implementation as very effective to project delivery. Table 4.4 shows a summary of the respondents' responses to the interviews on the implementation of construction management tools. The respondents are coded from respondent CO1 to CO10, the tools used on their site for their projects were noted, the level of expertise and the effectiveness were clearly outlined.

Table 4.4: Interview Responses on Implementation

Respondent	Implementation	Level of expertise	Effectiveness
CO1	Work break down, Critical Path, Network Analysis, Gantt Chart	Advance	Effective
CO2	Critical Path, Network Analysis	Advance	Effective-Moderate
CO3	Work Breakdown, Gantt Chart	Expert	Effective
CO4	Critical Path, Network Analysis, Gantt Chart, Prince 2, Cost Analysis, Work break down, Spread Sheet, PERT, GERT, Cost Analysis, Lean, Just In Time, Monte Carlo, Project Sensitivity	Beginner	Not Applicable
CO5	None	Intermediate	Effective-Moderate
CO6	Critical Path, Network Analysis Work Break down, Gantt Chart	Advance	Effective-Very
CO7	Spread sheet	Expert	Effective-Very
CO8	Critical Path, Network Analysis Work Break down, Gantt Chart	Expert	Effective-Very
CO9	Spread sheet, Cost Analysis	Expert	Effective-Very
CO10	Critical Path, Network Analysis Work Break down, Gantt Chart Spread sheet, Cost Analysis	Advanced	Effective-Moderate

4.4 Barriers to the use of Construction Management Planning Tools

Table 4.5 shows twenty barriers to effective implementation of construction management planning tools that were ranked using mean score ranking in descending order. The mean score of these barriers are between 5.802 and 5.000. Table 4.5 further shows that all these barriers to effective implementation of construction management planning tools are statistically significant at ($P<0.05$) by the respondents using a one-simple t-test value of 3.5. From the table, the barriers range from CM-Cost Management (mean=5.802; SD=2.455; t

(90) = 8.946; p=0.000<0.05) which ranked highest to PP-Passive Participation (mean=5.000; SD=1.995; t(93)=7.291; p=0.000<0.05) that ranked lowest in the table. To get the most significant of these barriers using the mean score, a test value of 3.5 was set. This same test value was used in previous similar research work Olanrewaju and Okorie (2019) to assess significant variables. All these barriers are greater than 3.5 and are considered to be statistically significant. All these variables can potentially prevent the implementation of construction management planning tools on construction sites in Abuja.

Table 4.5 Barriers to the use of Construction Management Planning Tools.

Barriers (Coding)	Mean	SD	T	Df	Sig(2-tailed)	Ranking
CM	5.802	2.455	8.946	90	.000	1
PMM	5.419	1.808	10.239	92	.000	2
COM	5.413	1.835	10.001	91	.000	3
PRM	5.402	1.822	10.013	91	.000	4
SM	5.391	1.833	9.894	91	.000	5
PC	5.366	1.887	9.535	92	.000	6
KM	5.366	1.837	9.808	92	.000	7
LOPE	5.348	1.980	8.950	91	.000	8
PMB	5.330	1.816	9.768	93	.000	9
QM	5.323	2.039	8.622	92	.000	10
SCAT	5.312	1.847	9.458	92	.000	11
CFM	5.255	1.747	9.741	93	.000	12
CADM	5.228	1.870	8.865	91	.000	13
PDP	5.223	1.890	8.839	93	.000	14
HRM	5.200	1.905	8.697	94	.000	15
PM	5.192	1.980	8.283	93	.000	16
IM	5.178	1.821	8.740	89	.000	17
MOTR	5.097	2.000	7.698	92	.000	18
RM	5.011	2.002	7.236	91	.000	19
PP	5.000	1.995	7.291	93	.000	20

4.5 Drivers to Construction Management Planning Tools

Ten professionals were interviewed on the drivers of construction management tools. They all agreed that government regulations and policy is necessary as part of the requirement for approval for construction projects.

Seven of the professionals interviewed emphasised on the need for more education and training on construction management tools which in some opinion should be provided by their organisation. Organisations are very interested in investing in different types of training like seminars, workshops, conferences and the likes and professional bodies and the academia are always engaging in such training activities from time to time. Clients' awareness on construction management tools was also noted as part of the drivers by 1 respondent. 2 of the professionals emphasised the need for clients' commitment to implementing construction management tools on their projects.

Table 4.6 below shows the respondents coded CO1, CO2, CO3, CO4, CO5, CO6, CO7, CO8, CO9 and CO10; this represented 10 respondents along with their views and opinion of the drivers of construction management tools.

Table 4.6 Drivers to Construction Management Planning Tools

Respondent	Drivers
CO1	Government Involvement with management policy, client commitment
CO2	Government intervention, client commitment
CO3	Government regulations and guideline, societal awareness, use of application software
CO4	Training and Education, Management Policy, regulations and guideline
CO5	Regulation, guideline, training and education
CO6	Regulation, guideline, Training and Education
CO7	Regulation, guideline, Training and Education
CO8	Regulation, guideline, Training and Education
CO9	Regulation, guideline, Training and Education
CO10	Regulation, guideline, Training and Education

4.6 Strategies for Implementation of Construction Management Planning Tools.

The strategies for the implementations of construction management planning tools for effective project delivery on the construction sites in Abuja were considered using qualitative and quantitative analysis. Mean score ranking was used to rank the project delivery and strategies, the first five highest ranking were considered for multiple regression analysis.

Table 4.7 Strategies for Implementation of Construction Management Planning Tools

Variables of Strategies (Code)	N	Mean	Rank	Std. Deviation
IACT	95	6.358	1st	7.49314
PIT	96	5.781	2nd	1.67460
EAT	95	5.695	3rd	1.58499
WCDT	94	5.692	4th	1.58641
EDPR	95	5.684	5th	1.56602
CSCP	95	5.674	6th	1.56723
IMTBR	94	5.660	7th	1.61014
CACT	94	5.649	8th	1.50059
GSSS	95	5.611	9th	1.64572
ECCM	95	5.579	10th	1.47734
ITPO	92	5.576	11th	1.52801
TCMT	95	5.558	12th	1.51388
DAKPI	94	5.552	13th	1.62785
CBKP	94	5.547	14th	1.50013
ACVT	95	5.543	15th	1.58396
WPGPA	95	5.538	16th	1.57120
GRSFI	94	5.526	17th	1.60347
BCPAD	95	5.511	18th	1.51512
IIIS	96	5.452	19th	1.50012
RPTC	95	5.396	20th	1.62585

From Table 4.7, the five highest on the mean ranking are Industry and Academia Collaboration On Training (IACT) has a mean score of 6.3579, Proper Implementation of

these Tools (PIT) has a mean score of 5.7813, Education and Training Within Company (EAT) has a mean score of 5.6947, Workers Commitment And Dedication to The Use Of These Tools (WCDT) has a mean score of 5.6915 and Ensuring Of Documented Procedure to be Used as Reference (EDPR) has a means score of 5.6842 among the strategies for effective implementation of construction management planning tools.

4.7 Project Delivery Measures

The project delivery measures were also ranked using the means score ranking as can be seen in the Table 4.8 below, Delivery on Time (DOT) has a mean score of 6.0515 ranked highest followed by Client Satisfaction on Service (CSOS) has a mean score of 5.9787, Value for Money (VFM) has a mean score of 5.9468, Excellent Commissioning (EC) has a mean score of 3.8938 and Adherence to Cost of Project Execution (ACPE) has a mean score of 5.8723. The five highest on the mean score is considered for project delivery.

Table 4.8 Project delivery measures

Project delivery measures (Coding)	N	Mean Scores	Rank	Std. Deviation
DOT	97	6.0515	1st	1.71009
CSOS	94	5.9787	2nd	1.56562
VFM	94	5.9468	3rd	1.66796
EC	96	5.8958	4th	1.59920
ACPE	94	5.8723	5th	1.58103
APT	96	5.8646	6th	1.75091
MASO	95	5.8000	7th	1.70481
CM	91	5.7912	8th	2.45183
ASPR	94	5.7660	9th	1.51285
APM	95	5.5895	10th	1.66628
BTC	94	5.5854	11th	1.66823
RPTC	95	5.3958	12th	1.62585
Q.M	93	5.3226	13th	2.03855
PM	94	5.2021	14th	1.97609

4.8 Relationship Between Variables of Strategies and Variable of Project Delivery

The result of the multiple regression analysis between the variables of strategies (WCDT, IACT, EDPR, PIT, EAT) and variable of project delivery (DOT) shows R square of 0.429 as seen in Table 4.9. This denotes that the independent variables can explain 42.9% variance in the dependent variable.

The Significant F Change in table 4.9 is 0.000, less than the p value (P<0.005), which shows that the relationship between the dependent and independent variables is significant. The ANOVA value in Table 4.10 shows a significant relationship. Therefore, the null hypothesis is rejected while the alternative hypothesis that there is significant relationship between the strategies for implementation of construction management planning tool and project delivery is accepted.

Table 4.9 Relationship between variables of strategies and variable of Project Delivery

Model	1
R	.655[R]
R Square	.429
Adjusted R Square	.396
Std. Error of Estimate	1.34297
R Square change	.429
F Change	13.209
df1	5
df2	88
Sig. F Change	.000
Durdin-Watson	1.893

a. Predictors: (Constant), WCDT, IACT, EDPR, PIT, EAT

b. Dependent Variable: DOT

Table 4.10 ANOVA (Relationship between Strategies and Project Delivery)

	Model	Sum of square	Df	Mean Square	F	Sig.
1	Regression	119.117	5	23.823	13.209	.000[b]

Residual	158.713	88	1.804
Total	277.823	93	

a. Dependent Variable: DOT
b. Predictors: (Constant), WCDT, IACT, EDPR, PIT, EAT

4.8.1 Client satisfaction on service (CSOS)

The project delivery here is considered on Client Satisfaction on Service factor with R Square value of 0.408 which is less than as seen in Table 4.11. The value of the Significant F change is 0.000 which is less than the p value ($p<0.005$) this shows that the value is significant, the value of the F on the ANOVA is 11.865 as shown on table 4.12.

Table 4.11 Model Summary[b] (CSOS)

Model	1
R	.639[R]
R Square	.408
Adjusted R Square	.374
Std. Error of Estimate	1.24954
R Square change	.408
F Change	11.865
df1	5
df2	86
Sig. F Change	.000
Durdin-Watson	1.739

a. Predictors: (Constant), WCDT, IACT, EDPR, PIT, EAT
b. Dependent Variable: CSOS

Table 4.12 ANOVA (Client Satisfaction on Service)

Model	Sum of square	Df	Mean Square	F	Sig.

1	Regression	92.627	5	18.525	11.865	.000[b]
	Residual	134.275	86	1.561		
	Total	226.906	91			

a. Dependent Variable: CSOS
b. Predictors: (Constant), WCDT, IACT, EDPR, PIT, EAT

4.8.2 Value for money (VFM)

The project delivery here is considered on value for money factor with R Square value of 0.306 which is less than as seen in Table 4.13. The value of the Significant F change is 0.000 which is less than the p value ($p < 0.005$) this shows that the value is significant; the value of the F on the ANOVA is 7.600 as shown on table 4.14.

Table 4.13 Model Summary[b] (VFM)

Model	1
R	.554[R]
R Square	.306
Adjusted R Square	.266
Std. Error of Estimate	1.44134
R Square change	.306
F Change	7.600
df1	5
df2	86
Sig. F Change	.000
Durdin-Watson	1.715

Table 4.14 ANOVA (Value for Money)

	Model	Sum of square	Df	Mean Square	F	Sig.
1	Regression	78.946	5	15.789	7.600	.000[b]
	Residual	178.662	86	2.077		

Total	257.609	91

a. Predictors: (Constant), EDPR, IACT, EAT, PIT, WCDT

b. Dependent Variable: VFM

4.8.3 Excellent commissioning (EC)

The project delivery here is considered on Excellent Commissioning factor with R Square value of 0.266, less than 1 as seen in Table 4.15. The value of the Significant F change is 0.000 which is less than the p value ($p < 0.005$) this shows that the value is significant, the value of the F on the ANOVA is 6.299 as shown on table 4.16.

Table 4.15 Model Summary[b] (EC)

Model	1
R	.516[R]
R Square	.266
Adjusted R Square	.224
Std. Error of Estimate	1.35162
R Square change	.266
F Change	6.299
df1	5
df2	87
Sig. F Change	.000
Durdin-Watson	1.647

a. Predictors: (Constant), EDPR, IACT, EAT, PIT, WCDT
b. Dependent Variable: EC

Table 4.16 ANOVA (Excellent Commissioning)

Model	Sum of square	Df	Mean Square	F	Sig.

1	Regression	57.534	5	11.507	6.299	.000[b]
	Residual	158.939	87	1.827		
	Total	216.472	92			

a. Dependent Variable: EC
b. Predictors: (Constant), EDPR, IACT, EAT, PIT, WCDT

4.8.4 Adherence to cost of project execution (ACPE)

The project delivery here is considered on Adherence to Cost of Project Execution factor with R Square value of 0.384 which is less than 1 as seen in Table 4.17. The value of the Significant F change is 0.000 which is less than the p value ($p < 0.005$) this shows that the value is significant; the value of the F on the ANOVA is 10.736 as shown on table 4.18.

Table 4.17 Model Summary[b] (ACPE)

Model	1
R	.620[R]
R Square	.384
Adjusted R Square	.349
Std. Error of Estimate	1.28644
R Square change	.384
F Change	10.736
df1	5
df2	86
Sig. F Change	.000
Durdin-Watson	1.744

a. Predictors: (Constant), EDPR, IACT, EAT, PIT, WCDT
b. Dependent Variable: ACPE

Table 4.18 ANOVA (Adherence to Cost of Project Execution)

Model		Sum of square	df	Mean Square	F	Sig.
1	Regression	88.839	5	17.768	10.736	.000[b]
	Residual	142.324	86	1.655		
	Total	231.163	91			

a. Dependent Variable: ACPE
b. Predictors: (Constant), EDPR, IACT, EAT, PIT, WCDT

4.8.5 Discussion on One-Way Analysis of Variance (ANOVA)

The Kruskal-Wallis one-way ANOVA is utilised to determine if there are any significant mean differences between more than two groups of variables. Based on the respondents' professions, a one-way ANOVA test was done to examine the respondents' divergent perspectives on the strategies of construction management planning tools for effective project delivery in Abuja (Architect, Builder, Engineer, Project Manager, and Quantity Surveyor). The difference statistically of opinion in the rankings of the strategies for implementation of construction management tools, project delivery is considered on all the strategies on R Square value of each is less than as seen in each table from Table 4.11, 4.13,4.15,4.17 respectively. The prior study used the same level of significance of 0.005. Table 4.10 to 4.18 shows the value of the significant F change is 0.000 which less than p value and shows that there is significant (p<0.005), The value of ANOVA is 11.865, 7.600, 6.299, 10.736 as shown on table 4.12, table 4.14, table 4.16 and 4.18 respectively. The findings show despite having varying professional background, there was similarity among them in the response to the strategies implemented, but their variables are dependent on the predictors which are constant (EDPR, IACT, EAT, PIT, WCDT). That is, delivery on time (DOT), CSOS, VFM, EC, ACPE depend on the strategies implemented.

4.9 Summary of Findings

Most of the professionals that responded to the questionnaires and interview for this research work were well experienced on the field, well read and in various discipline within the construction industry as can be seen in the demographic Table 4.1.

Objective one: From the study 20 construction management planning tools or construction management tools were considered and most of the professionals are knowledgeable on these tools and utilised them for their work. From the factor analysis ranking of these tools as shown in Table 4.3 Waterfall method ranked highest followed by Gantt chart and GERT which CPM ranked lowest. However, all the construction management tools are in use within the industry in Abuja.

Objective two: From the content analysis, it can be seen that the construction management tools were implemented with 90% of the respondents actively using these tools. Critical Path, Network Analysis Work Breakdown, Gantt chart and spread sheet were prominent among these tools.

Objective three: Some barriers to the successful implementation of these tools were identified as seen in Table 4.4 Cost management ranked highest on the list of barriers to the implementation of construction management tools, this shows that their seems to be low investment into this tools as some involved purchase of software and training for effective usage. Communication management ranked second showing that some business owner may not have a proper understanding on construction management tools and as such be unwilling to listen to professionals promoting the implementation of construction management tools. Passive participation ranked lowest which means it has no significance to the implementation of construction management tools.

Objective four: Content analysis carried out on the Drivers showed that government regulation and guidelines and training on these tools are key to successful implementation of construction management tools on construction projects in Abuja

Objective five: Strategies for the implementation of construction management tools were ranked and industry and academia collaboration ranked highest showing the need for such collaboration. Proper implementation of these tools ranked second showing the need not only to know the tools but that management will adequately implement the tools on construction projects.

For project delivery ranking was done to select the most ranked five measures and the strategies. From the regression analysis it shows that dependent variable is significantly imparted by the predictors. This means whenever the predictors are available there will be effective project delivery.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In this study, identifying construction management planning tools currently employed in project delivery in Abuja revealed a range of software and systems utilized. The assessment of their implementation levels highlighted discrepancies in adoption among construction firms. Barriers identified included resource constraints and technological limitations, while drivers encompassed the pursuit of efficiency and improved project outcomes. These findings culminated in the proposition of comprehensive strategies to enhance the effective implementation of construction management planning tools, emphasizing the importance of addressing resource constraints and fostering technological integration for optimized project delivery in Abuja.

From the study, the following conclusions are drawn; construction management tools are necessary tools for construction projects in Abuja and all across the nation. There is a need for government regulations to include construction management project tools as part of the necessity for construction project approval. Companies and organisations involved in construction projects must ensure they use construction management tools. Construction management tools training should be regular, and professionals are to be constantly updated as technology progresses. Also, academia and industry collaboration should increase on the subject of construction management tools. Worker's commitment should be directed to speedy learning of new technologies and software and their implementation. Management's interest should be geared toward effective implementation of construction management tools as well as monitoring to ensure compliance.

5.2 Recommendations

i. Public and private organisation should make tangle effort towards the implementation of these project management tools

ii. Government should go beyond policy to playing supervisory role in ensuring adequate implementation of construction management tools on site.

iii. Government should implement disciplinary action upon erring companies and organisations that fail to implement construction management tools in Abuja and nationwide.

iv. Companies must regularly train staff on available and emerging construction management tools, especially at middle and management level.

v. Private and public construction organisations should ensure documentation on construction management tools on projects to serve as reference to ongoing and future projects.

5.3 Contribution to Knowledge

The study makes several significant contributions to the field of construction management and project delivery, particularly in the context of Abuja, Nigeria.

i. Local Contextualization: The research contributes by contextualizing project management and planning strategies to the specific needs and challenges of the construction industry in Abuja. It takes into account the unique socio-economic, environmental, and regulatory factors that influence construction projects in the region.

ii. Improved Project Efficiency: The study provides valuable insights into the practical implementation of construction management planning tools. By identifying effective

strategies, it contributes to enhancing project efficiency, reducing delays, and optimizing resource allocation in construction projects within Abuja.

iii. Local Industry Advancement: The research assists in advancing the local construction industry by introducing and promoting the adoption of modern management tools and techniques. This, in turn, supports the growth of a more competitive and innovative sector.

iv. Sustainable Development: The study can also contribute to the promotion of sustainable construction practices in Abuja. By optimizing project delivery, it can potentially reduce the environmental footprint of construction activities, aligning with global sustainability goals.

v. Empirical Evidence: The research potentially offers empirical evidence on the effectiveness of specific strategies and tools in the Abuja construction context, which can guide project managers, stakeholders, and policymakers in making informed decisions.

5.4 Area of Further Studies

i. Cross-Cultural Project Management: Investigate how cultural factors impact construction project management in Abuja, especially in international collaborations or diverse workforces.

ii. Innovative Project Delivery Models: Explore the implementation of alternative project delivery models, such as design-build, public-private partnerships (PPPs), and integrated project delivery (IPD), to assess their suitability and efficiency in the Abuja construction industry.

iii. Green Building Practices: Examine the adoption and impact of sustainable and green building practices in Abuja, focusing on energy-efficient design, materials, and construction methods, and their effects on project delivery.

iv. Infrastructure Development: Research the specific challenges and strategies related to managing large-scale infrastructure projects in Abuja, including transportation, utilities, and urban development, and how they differ from traditional construction projects.

v. Construction Dispute Resolution: Investigate effective mechanisms for resolving construction disputes and claims in Abuja, including the use of alternative dispute resolution (ADR) methods, legal frameworks, and their impact on project timelines and costs.

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APPENDIX A
QUESTIONNAIRES

Department of Building,
School of Environmental Technology,
Federal University of Technology,
P.M.B. 65,
Minna, Niger State.
6th February, 2023

Dear Respondent,

Re: Strategies for Implementation of Construction Management Planning Tools in Effective Project Delivery in Abuja, Nigeria.

My name is **SALAKO, Bidemi Abdulazeez** a Master student in Construction Management**,** Department of Building, School of Environmental Technology, Federal University of Technology Minna, Niger State conducting research on **"Strategies for Implementation of Construction Management Planning Tools for Effective Project Delivery in Abuja, Nigeria".**

Your participation in filling of the questionnaire will be very helpful.

Please note that all information provided will be used for academic purposes, therefore, do not include your name or telephone number in your response.

If you have questions or observations at any time about the survey or procedures, please contact me or my supervisor.

Thank you very much for your support.

SALAKO, Bidemi Abdulazeez
Phone no. 08033740251
E-mail: salakoazeez@gmail.com
Abdulazeez.pg.209089@st.futminna.edu.ng

Dr. (Mrs) A. A. Bamgbade
Project Supervisor
bisbam@gmail.com

SECTION A: GENERAL INFORMATION OF RESPONDENTS

1. Name of Organisation (Optional)
   _____

2. Gender: Male ☐ Female ☐

3. Profession: Project manager ☐ Builder ☐ Quantity Surveyor ☐

   Architect ☐ Engineer ☐ others, please specify_____

4. Years of experience in the construction industry: Less than18 ☐ 19-24 ☐

   25-29 ☐ 30-34 ☐ 35-39 ☐ 40-44 ☐ 45-49 ☐ Greater than 50 ☐

5. Academic Qualification: ND ☐ HND ☐ BSc / BTech ☐ ☐
   MSc/MTech. Others, please specify_____

6. Professional body in the Organisation: CORBON ☐ COREN ☐ ☐
   ARCON

   QSRBON ☐ Others, please specify_____

SECTION B: RESEARCH OBJECTIVES

Objective No 1: Identification construction management planning tools currently in use in project delivery in Abuja.

From the scale of **7 (strongly disagree) 6 (disagree) 5 (more or less disagree) 4 (undecided) 3 (more or less agree) 2 (agree) to 1 (strongly agree),** kindly state your level of agreement with the following construction management planning tools currently in use in project delivery in Abuja:

SN	Identification construction management planning tools currently in use in project delivery in Abuja.	7	6	5	4	3	2	1
1	Work breakdown							
2	Gantt chart							
3	Line of balance							
4	Network Analysis							
5	Prince 2							
6	Project sensitivity analysis							
7	Cost benefit analysis							
8	Graphical evaluation and review technique (GERT)							
9	Programme evaluation and review technique (PERT)							
10	Lean construction management technique							
11	Just in time method (JIT)							
12	Monte carlo technique							
13	Critical path method							
14	Spread sheet							
15	Benchmark job technique							
16	Cost of quality							
17	Expert judgement techniques							
18	Critical Chain Method Technique							
19	Water fall Method							
20	Classic Technique							

Objective No 2: Level of implementation of construction management planning tools in project delivery.

From the scale of Using the scale of **7(strongly disagree), 6 (disagree), 5 (somewhat disagree) 4 (neutral) 3 (somewhat agree) 2 (agree) to 1 (strongly agree);** kindly respond by placing a tick to show the level of agreement of the following level of implementation of construction management planning tools in construction firms in Abuja:

SN	Level of implementation of construction management planning tools in project delivery	7	6	5	4	3	2	1
1	Work breakdown							
2	Gantt chart							
3	Line of balance							
4	Network Analysis							
5	Prince 2							
6	Project sensitivity analysis							
7	Cost benefit analysis							
8	Graphical evaluation and review technique (GERT)							
9	Programme evaluation and review technique (PERT)							
10	Lean construction management technique							
11	Just in time method (JIT)							
12	Monte carlo technique							
13	Critical path method							
14	Spread sheet							
15	Benchmark job technique							
16	Cost of quality							
17	Expert judgement techniques							

Objective No 3: Barriers to the use of construction management planning tools.

From the scale of Using the scale of **7 (strongly disagree), 6 (disagree), 5 (somewhat disagree) 4 (neutral) 3 (somewhat agree) 2 (agree) to 1 (strongly agree);** kindly respond by placing a tick to show the level of agreement of the following barriers to the use of construction management planning tools in construction firms in Abuja:

SN	Barriers to the use of construction management planning tools in construction firms in Abuja	7	6	5	4	3	2	1
1	Risk management							
2	Human resources management							
3	Project definition and planning (poor planning)							
4	Performance management (bad management)							
5	Knowledge management							
6	Stakeholder management							
7	Cost management							
8	Conflict and dispute management							
9	Communication management							
10	Procurement management							
11	Quality management							
12	Cash flow management							
13	Lack of experience							
14	Misuse of time and resources							
15	Project management framework							
16	Passive participation							
17	Project management methodologies							
18	Inventory management							

Objective No 4: Drivers to construction management planning tools.

From the scale of Using the scale of **7 (strongly disagree), 6 (disagree), 5 (somewhat disagree) 4 (neutral) 3 (somewhat agree) 2 (agree) to 1 (strongly agree);** kindly respond by placing a tick to show the level of agreement of the following drivers to construction management planning tools on construction firms in Abuja:

SN	Drivers to construction management planning tools on construction firms in Abuja	7	6	5	4	3	2	1
1	Training and education in management							
2	Client commitment and involvement							
3	Government involvement through introduction of management policy, regulation and guidelines							
4	Proper understanding of management methodology and practice							
5	Societal awareness of its benefits and application							
6	Usage of electronics construction management study approach							
7	Establishment of group support system (GSS) on construction management							

Objective No 5: Strategies for implementation of construction management planning tools.

From the scale of Using the scale of **7 (strongly disagree), 6 (disagree), 5 (somewhat disagree) 4 (neutral) 3 (somewhat agree) 2 (agree) to 1 (strongly agree);** kindly tick as appropriate, the strategies for the implementation of construction management planning tools for effective project delivery in construction firms in Abuja:

SN	Strategies for the implementation of construction management tools for effective project delivery in construction firms in Abuja	7	6	5	4	3	2	1
a)	**Guidance/ guideline on the use of modern technology**							
1	Integrate modern technology with building regulations							
2	Wider publicity for generating public awareness							
3	Education and training within company							
4	Industry academia collaboration on training							
5	Government support to ensure finance and insurance							
6	Collaboration/ partnering between key parties							
b)	**Implementation project management software**							
7	Articulating a clear set of values and targets							
8	Basing construction plans around data							
9	Including training programs in operations							
10	Determine appropriate key performance indicator (KPIs)							
11	Regulating profitability and track costs							
c)	**Monthly regulatory body inspection to ensure practice**							
12	Government supervision on setting standard							
13	Ensuring of documented procedure to be used as reference							
14	Transfer of construction management techniques from other field of profession							

15	Early detailed course on construction management for early awareness							

Measures for effective project delivery in construction industry in Abuja.

From the scale of Using the scale of **7 (not very important), 6 (not adequate important), 5 (not important) 4(less important) 3 (more important) 2 (important) to 1 (very important);** tick your level of agreement on measure of effective project delivery:

SN	**Measures for effective project delivery in construction industry in Abuja**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
a)	**Critical success factor**							
1	Delivery on time							
2	Adherence to quality targets							
3	Adherence to cost of project							
4	Adherence to health and safety of safety of workers							
b)	**Project success**							
6	Assigning individual responsibility to attain benefits and have a mechanism to capture and share lessons learnt							
7	Client satisfaction on service							
8	Functional requirements							
9	Technical specification							
10	Solving customer's problem							
11	Future opportunities							
12	User satisfaction on product							
13	Meets stated objectives							
14	Benefit to clients							
15	Fitness for purpose							
16	Value for money							
17	Benefit to end user							
18	Business needs							
19	Useable life expectancy							
20	Develop new business relationship							
21	Develop new knowledge and expertise							
22	High profit margin							
23	Business needs							
24	New market penetration							
25	Generate positive							

26	Increase level of professionalism							
27	Corporate mission							
28	Excellent commissioning							
29	Excellent closeout process							

APPENDIX B
INTERVIEW GUIDE

1. What is the professional composition of your organisation?

2. What is the highest academic qualification on your site?

3. Are your key staff professionally qualified?

4. What is your profession?

5. How many years have you been practicing?

6. Are construction management tools used on your site?

7. Can you list the construction management tools that are implemented on your site?

8. What is your assessment on the implementation of construction management tools in your organisation?

9. How effective are the implementation of construction management tools to your project delivery?

10. Can you list the construction management tools that you know?

11. Can you list the construction management tools that you use?

12. What is your level of understanding of those tools that you use?

i. Beginner

ii. Intermediate

iii. Advance

iv. Expert

13. Do you attend any training on construction management tools?

14. Does your company/organisation sponsor training/conference/workshop, seminar on construction management tools

15. How does construction management tools affect your projects delivery?

i. In term of Project timeline

ii. Project profitability

iii. Quality of work

iv. Clients Satisfaction with your project delivery

16. In your opinion what are the drivers of construction management tools

17. What are the disadvantages of using construction management tools?

18. Do you have any barrier/s to the implementation of construction management tools in your organisation?

19. What are these barriers?

20. How do these barriers affect your project delivery?

21. What do you think can be done to overcome these barriers?

22. What are factors that can enhance the use of construction management tools?

23. How best can construction management tools be implemented effectively?

24. How well will you be willing to learn and adapt to emerging latest construction management tools?

25. What are the strategies for the implementation of construction management technique for effective project delivery in construction industry?