IMPACT OF APPLICATION OF COMPUTER SOFTWARE IN MANAGEMENT OF BUILDING CONSTRUCTION PROJECT IN KWARA STATE

BY

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2016/1/63731TI

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION, SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

APRIL 2023

CERTIFICATION

I ADELEKE, David Adesoji, Matric No. 2016/1/64072TI an undergraduate of the department of industrial and technology education, certify that the work embodied in this project is original and has not been submitted in part or full for any other degree or diploma of this or any other institution

ADELEKE, David Adesoji   _____

2016/1/64072TI   Signature and Date

CERTIFICATION

This project has been read and approved as meeting the requirement for the award of B.Tech degree in Industrial and Technology Education, school of science and technology education, Federal University of Technology, Minna.

Dr. A.B. Kagra
_____   _____
Project supervisor   Signature and Date

Dr. T.M Saba
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Head of department   Signature and Date

_____   _____
External Examiner   Signature and Date

DEDICATION

I gratefully dedicate this project to Almighty God whom in His infinite mercy preserved my life to see the end of this programme. In spite of all odds His love, protection, provision and above all His grace saw me through. I specially dedicate this project to my mother's Dorathy Adeleke and Mrs. Comfort Nwajua and my late father Mr. David Adeleke.

ACKNOWLEDGEMENTS

First and foremost, I wish to glorify the Almighty for the opportunity, provided by his mercies to fulfill my dream of completing my project work in particular and my B.Tech degree in general.

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I thank my family members most especially my sister and her husband Mr. and Mrs. Emmanuel Abayomi and my brothers Chinedu, Bola, Micheal, Uzo, Alochukwu for their support toward my life and my academic. I also appreciated the contribution of my friends and also my course mate to the success of this work which are Isaac, Simeon, Chidi, Joseph,

Abass may God almighty crown their effort with success May God Almighty bless you all.

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ABSTRACT

The study was design to determine the impact of computer software in management of building construction project in Kwara State. Three research questions were answered and two hypotheses were used to guide the study. A structured questionnaire which was developed by the research and was used for data collection. The structured questionnaire was validated by three (3) experts from the department of industrial and technology education. The validated instrument was prepared for a population of fifty (50) contractors and thirty (30) site engineers in some selected construction companies in Ilorin Kwara State. The instrument was administered to the respondent with the help of three (3) research assistant. The research questions answers were analyzed using frequency counts, mean and standard deviation while the t-test used to analyze the hypothesis at 0.05 level of significance. Findings revealed that all the constructors and site engineers in building construction project know about the types of computer software in Kwara State. Findings of the study also revealed that the contractors and site engineer all agreed to the benefit and the challenges of the adoption of computer software by construction companies in Kwara State. The study recommends that improving the attractiveness of the industry through rigorous advocacy for construction sector Research and Development (R & Ds). It also recommended by Introducing rigorous sectoral software skills training, networking and advocacy for involvement of industry stakeholders.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The advent of computer and the advancement of chip technology paved the way for tremendous development in formation gateway. For instance, the quantity surveying profession is at the centre of management of construction resources, and cost an indispensable construction resource. Computer has promised to be a veritable tool in all phases of human endeavor. Thus it expected that its usefulness to the construction cost manager be beyond controversy.

The global economic dynamism and growing use of ICT in the major sectors is a welcome development. All over the world, the technology has been having a major impact on economic development (Idowu, 2010). Information and Communication Technology software, also known as information technology (IT) has radically transformed the way we live, learn, work and play (Capron 2000). Many companies in the construction industry do not generally appear to have appreciated the positive changes and advantages that the new technology was providing to companies in other sectors of the economy. A major construction process demands heavy exchange of data and information between project participants on a daily basis (Masqsood et al., 2004). This makes the construction industry one of the most information-intensive industries, and requires close coordination among a large number of specialized but interdependent organizations and individuals to achieve the cost, time, quality and sustainability goals of construction project (Ugwu et al., 2005).

Software has been shown to be a vital tool in assisting the construction industry to cope with the increasing complexity of its product and services as well as the increasing demands of clients and regulators (Betts,1999), and to enhance construction productivity (Liston et al., 2000). To asses the impact of software on construction in this regard, surveys on the use of software in the construction industries of various countries in different parts of the world have been carried out in recent times.

Information and Communication Technology (ICT), also known as information technology (IT) has radically transformed the way we live, learn, work and play. Many companies in the construction industry do not generally appear to have appreciated the positive changes and advantages that the new technology was providing to companies in other sectors of the economy. A continuum of survey exists which studies the level of application of ICT in construction industries of various countries in recent times. Most of the survey had been carried out in developed economies, although attempts have been made to carry out the survey in developing and emerging economies such as South Africa in 1999 (Arif and Karam, 2001), Nigeria in 2005 (Oladapo, 2007). Their studies however revealed that the digital divide between emerging economies such as Nigeria and the developed world is closing up as more and more computer facilities are becoming accessible. However the study also indicated that modern and advanced information and communication facilities such as internet, intra/extranet, virtual reality tools are grossly inadequate.

Studies have been carried out to determine the critical success factors, the barriers and enablers to ICT application in construction projects to harness the technology and

streamline business process in emerging economies. The general problem addressed is what are the critical success factors, (CSFs), and barriers that impact the implementation, adoption, usage and diffusion of ICT in the construction industry. Such a framework should enable identification of at-risk IT projects during the early stages of project evaluation and facilitate formulation of appropriate risk mitigation measures.

There is an abundance of documented literature that describes various projects in construction, which focus on ICT-driven construction process innovation. However, while the majority of the research focuses on developing improved products, process and computational models, there is a noticeable dearth of research that focuses on issues and factors that impinge on the uptake of ICT systems in construction, including stakeholders' perceived benefits, cost and risks of ICT systems in practice. An adequate understanding of perceived and expected benefits would facilitate an unambiguous understanding of user requirements and subsequent translation into system functional specification during development. ICT implementation in construction results in significant changes and potential improvements in design and management processes within the organization. It is therefore necessary to investigate critical success factors as well as inhibiting factors.

Other researchers reported in literature have focused on investigating the various basic and niche application areas of ICT in construction. Such studies have been conducted in The awareness and adoption of information and communication technology (ICT) by Architectural, Engineering and Construction industry educators in Nigeria, Adejimi and Iyagba (2005) compared E-construction technology for integrating building processes

between Nigeria, Canada and the Nordic countries. Their study however revealed that the digital divide between Nigeria and the developed world is closing up as more and more computer facilities are becoming accessible. However, they also indicated that modern and advanced information technology facilities such as internet, intra/extranet, virtual reality tools, tele/video conferencing, construction robots etc are grossly inadequate.

The construction sector is entails as an innovative sphere incorporating a wide range of knowledge entities and enterprises, involved in design, site preparation, construction supply lines and construction of buildings, building elements and steel work, building installation and joinery, maintenance and repairs. (Oladapo, 2007) and (Harvard, 2000). For instance, Bamisile (2005), Adenike (2007), Construction is a team work. It has been acknowledged that the process of building an edifice or any other engineering and construction is the collaborative responsibility of various professionals. All over the world, the trend is that of specialization, this is because better performance, effective delivery, high productivity and cost effectiveness could best be achieved through specialization. It is important to note that the involvement of all these specialized professionals under the delivery of building / construction project process is aimed at solving the demand of complexity of design and modern construction awareness on the part of the client Based on this background, the common traditional practice/ methodology of the building construction process have really faced extinction since the adoption of the ICT in most developing nation such as Nigeria.

In this era of IT, the building/construction industry ought to have left the old traditional method which involves the use of manual equipment for construction works and its attendant problems – time and cost overrun and at time poor quality jobs; to an improved and more standard method by using the ICT tools during construction process for process for more effective delivery of the project. This study seeks to assess the effect of the use of Information Communication Technology on the performance of construction project delivery in Nigeria.

The use of software in construction project management has been studied extensively over a years. In a study conducted by Wang et al. (2017), the authors explored the use of Building Information Modeling (BIM) software in construction project management. The study found that the use of BIM software improved communication, reduced errors, and communication, reduced errors, and improved the overall quality of the construction project. Another study by Walled et. al. (2020) examined the use of project management software in the construction industry. The authors found that the use of the software improved project planning, scheduling, cost management, and resource allocation.

One of the earliest software tools used for construction project management was the Critical Path Method (CPM), which was developed in the 1950s and 1960s. CPM was scheduling tool that helped project managers to identify the critical path of a project, which is the sequence of activities that must be completed on time in order to the project to be completed on schedule. CPM is still used today, although it is has been largely superseded by more advanced scheduling tools.

Another early software tools used for construction project management was PERT (Program Evaluation and Review Technique), which was developed by the US Navy. PERT was similar to CPM, but it placed greater emphaisis on risk management and uncertainty. PERT is still used today, particularly in projects where there is a high degree of uncertainty or risk.

In recent years, there has been a growing trend toward using cloud-based project management software tools, which allow project teams collaboration and share information in real-time from any location. Examples of cloud-based project management tools for the construction industry include Procore, PlanGrid, and Autodesk BIM 360. In addition to these studies, there are numerous other studies that have explored the use of various software application in construction project applications in construction project management. For example, a study by Kim and Kim (2020) explored the use of mobile applications in construction project management, while a study by Nawi et. al. (2019) examined the use of cloud-based project management software in construction project. It is against this backdrop that this research was set to investigate the impact of application of computer software in management of building construction project in Nigeria with particular reference to Kwara state.

1.2 Statement of Problem

It is obvious for the use of related ICT (Information Communication Technology) management tool which software stands out as one in this era of the world globalization and the resolution. Due to lack of knowledge of the existence of a programme like the

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computer software most building project construction in Nigeria were not constructed with guide from software for an effective project delivery. Very few project managers are aware of its existence computer software but don't know how to use it in their building project construction.

The construction sector is entails as an innovative sphere incorporating a wide range of knowledge entities and enterprises, involved in design, site preparation, construction supply lines and construction of buildings, building elements and steel work, building installation and joinery, maintenance and repairs. (Oladapo, 2006) and (Harvard, 2000). For instance, Bamisile (2004), Adenike (2007), Abimbola (2007), Construction is a team work. It has been acknowledged that the process of building an edifice or any other engineering and construction is the collaborative responsibility of various professionals. All over the world, the trend is that of specialization, this is because better performance, effective delivery, high productivity and cost effectiveness could best be achieved through specialization. It is important to note that the involvement of all these specialized professionals under the delivery of building / construction project process is aimed at solving the demand of complexity of design and modern construction awareness on the part of the client Based on this background, the common traditional practice/ methodology of the building construction process have really faced extinction since the adoption of the ICT in most developing nation such as Nigeria.

The use of software in building construction programme is bedevil with many problems. This is due to the fact that many state holders in the construction project are either not

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aware of the existence of computer software in construction or do not know how to use it. Numerous problems are being encountered by the construction companies in Nigeria. Most of these problems are software related. Therefore, this study seek to determine the impact of application of software in building construction project in kwara state.

1.3 Purpose of the Study

The purpose of this study is to examine the impact of application of computer software in management of building construction project in Kwara State. Specifically the study will;

1. Ascertain the awareness of different types of computer software application available for management of building project in Kwara State.

2. Determine the benefit for the adoption of computer software by construction companies in management of building project in Kwara State.

3. Find out the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

1.4 Significant of the Study

The finding of the study will specifically be of benefit to the Nigeria Construction Companies, Builders Contractors, Academics and Researcher will further save as roadmap to construction industries and stakeholders.

The findings of this study will benefit the construction companies as it will helps in determining the awareness of different types of computer software application available for management of building project by construction companies which enable operations through proper coordination and control of planning, design, estimating, contracting and

construction in the entire process and develop effective communications, mechanisms for resolving conflicts and improving the speed of construction of building project delivery.

The findings on the benefit for the adoption of computer software by construction helping companies in management of building project to manage budgeting communication, job scheduling, project estimating and more. Also this will help the construction companies for the ability to effectively coordinate management companies for the ability to effectively coordinate management over different projects and teams that span multiple locations, given the impact COVID-19 has had on the construction industry the benefits of construction software can help, give companies the upper hand amid the downturn.

Also, the finding on the challenges of the adoption of computer software by construction companies in management of building project; lack of flexibility that may have to contort its processes for the two systems to work together, costs involved in maintenance, poor project management, issues related to data migration, resistance by the organization's teams to change, resistance to change. This research was effectively carried out so as to let the IT in the construction companies in management of building project and how to manage them as possible in other to achieve them.

1.5 Scope of the Study

The study is on the impact of application of computer software in management of building construction project in kwara state. The study specifically covered the awareness types of computer software application available for management of building project, the benefit

for the adoption of computer software by construction companies in management of building project, the challenges of the adoption of computer software by construction companies in management of building project.

1.6 Research Questions

1. To what extent the management of construction companies are aware of different types of computer software in management of building project in Kwara State?

2. What are the benefit for the adoption of computer software by construction companies in management of building project in Kwara State?

3. What are the challenges of the adoption of computer software by construction companies in management of building project in Kwara State?

1.7 Hypotheses

The following null hypothesis were formulated to guide the study and also tested at 0.05 level of significant.

H_{o1}: There is no significant difference between the mean responses of contractors and the site engineers on the awareness of different types of computer software application available for management of building project in Kwara State.

H_{o2}: There is no significant difference between the mean responses of contractors and the site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

CHAPTER TWO

2.0   **LITERATURE REVIEW**

The literature review were discuss under the following headings

2.1 Theoretical Framework

2.1.1 ICT Application in the Global Construction Industry

2.1.2 The Development of Information and Communication Technology in Construction

2.2 Conceptual Framework

2.2.1 The extent to which management of construction companies are aware of different types computer software in management of building project

2.2.2 The benefit for the adoption of computer software by construction companies in management of building project

2.2.3 The challenges of the adoption of computer software by construction companies in management of building project

2.3 Review of Related Empirical Studies

2.4 Summary of the Review of Related Literature

2.1 Theoretical framework

2.1.1 ICT Application in the Global Construction Industry

The construction industry is one of the largest and most complex industries in the world. It involves the planning, design, and construction of buildings, infrastructure, and other facilities. With the increasing demand for sustainable and cost-effective construction projects, there has been a growing interest in the use of information and communication technology (ICT) applications in the global construction industry.

The use of ICT applications in the construction industry has the potential to improve productivity, safety, and efficiency in project management, design, and construction. The adoption of these technologies can also reduce costs, improve collaboration, and increase sustainability in the construction process.

Numerous studies have been conducted on the use of ICT applications in the global construction industry. For example, a study by Alashwal and colleagues (2018) investigated the use of Building Information Modeling (BIM) in construction projects in Saudi Arabia. The study found that the adoption of BIM led to improved collaboration among stakeholders, reduced project duration, and reduced errors and rework.

Another study by Zhang and colleagues (2019) examined the use of drones in the construction industry. The study found that drones can provide high-resolution images and data that can be used to improve project planning and reduce costs. Drones can also

improve safety on construction sites by providing real-time monitoring of workers and equipment.

These studies demonstrate the potential benefits of ICT applications in the global construction industry. However, there are also challenges to the adoption of these technologies, such as the cost of implementation, the need for specialized skills, and concerns around data security and privacy.

2.1.2 The Development of Information and Communication Technology in Construction

The construction industry has traditionally been seen as a slow adopter of new technologies, but the development of information and communication technology (ICT) is changing this perception. ICT has the potential to transform the way construction projects are designed, managed, and delivered, leading to improvements in productivity, efficiency, and quality.

Research into the development of ICT in construction has been ongoing for several decades. One early study from 1992, "The Use of Information Technology in Construction" by Richard Fellows and Alan Langford, explored the potential benefits of using ICT in construction and highlighted the need for further research into the subject.

Since then, there has been a significant amount of research conducted on the topic, including studies on the use of Building Information Modelling (BIM), virtual and augmented reality, and mobile technologies in construction. For example, a study by Saeed Abbas et al. (2018) titled "A Review of Building Information Modelling Applications in

Construction" examines the use of BIM in construction, including its benefits and challenges. The study concludes that BIM has the potential to improve collaboration, reduce errors and delays, and enhance the overall project management process.

Another study by Gokhan Senyigit et al. (2019) titled "The Use of Virtual and Augmented Reality Technologies in Construction" explores the use of these technologies in construction, including their potential benefits and challenges. The study concludes that virtual and augmented reality have the potential to improve communication, enhance safety, and reduce costs in the construction industry.

A third study by Karim Abdul et al. (2020) titled "Mobile Technology in Construction: A Systematic Review" examines the use of mobile technologies in construction, including their potential benefits and challenges. The study concludes that mobile technologies have the potential to improve communication, enhance productivity, and increase safety in the construction industry.

The development of ICT in construction has the potential to revolutionize the industry and lead to significant improvements in efficiency, productivity, and quality. Ongoing research into this subject is essential to ensure that the industry can fully realize the benefits of these technologies.

2.2   Conceptual framework

2.2.1   The extent to which management of construction companies are aware of different types computer software in management of building project

The management of construction companies requires knowledge and skills in utilizing different types of computer software for efficient and effective project management. Several studies have been conducted to investigate the extent to which management in construction companies are aware of the different types of software available for project management.

The management of building projects also involves the use of various computer software applications to assist in the planning, designing, and construction phases. It is important for project managers to have a good understanding of the different types of software available to ensure that they can effectively manage their projects. For example, a study by Cheung and Suen (2019) examined the level of awareness and adoption of digital technologies in the construction industry in Hong Kong. The study found that while there was a high level of awareness of digital technologies such as Building Information Modelling (BIM) and project management software, there was a lack of adoption due to factors such as the lack of incentives and resources to invest in these technologies.

Similarly, a study by Fathi et al. (2019) investigated the usage of project management software among construction companies in Iran. The study found that while there was a moderate level of awareness of project management software, the usage was limited due to factors such as the lack of knowledge and expertise in utilizing the software. Another study by Du and Xie (2019) focused on the awareness and adoption of BIM software among construction companies in China. The study found that while there was a high level

of awareness of BIM software, the adoption was limited due to factors such as the lack of government support and the perceived high cost of implementation.

Several studies have been conducted on the awareness of different types of computer software in the management of building projects. For instance, a study by Ibrahim et al. (2018) examined the level of awareness and use of building information modeling (BIM) software among construction professionals in Malaysia. The study found that while there was a high level of awareness of BIM software, there was a low level of usage due to the lack of knowledge and skills in using the software. Another study by Khan et al. (2020) focused on the use of project management software (PMS) among construction professionals in Pakistan. The study found that while there was a high level of awareness of PMS, there was a lack of understanding of its potential benefits in terms of improving project efficiency and reducing costs.

Similarly, a study by Al-Shammari and Al-Jibouri (2019) investigated the awareness and usage of construction management software (CMS) among construction professionals in Iraq. The study found that while there was a high level of awareness of CMS, there was a low level of usage due to the lack of resources and infrastructure to support the software.

These studies highlight the importance of increasing awareness and understanding of different types of computer software in the management of building projects, and the need to provide training and resources to support their usage.

Types of computer software in management of building project

- Computer Aided Design and Visualization
- Building Engineering Applications

- Microsoft Project

- GanttPRO

- BIM 360

- Acculynx

- Jonas Premier

- Procore

- CoConstruct

- Buildertrend

- Knowify

- ProContractor

- PlanGrid

- Projectmates

- eSUB Subcontractor

- WorkflowMax

- SiteMax

- BuildTools

- Radar

- Jonas Enterprise

- Committed Cost

1. Computer Aided Design and Visualization

Computer Aided Design (CAD) software is widely used by design professionals and

AutoCAD has the largest share of the CAD market (Howard 1998). Other popular CAD

software includes Microstation, ArchiCAD, MiniCAD, FastCAD, Autodesk Revit etc. These CAD programs have largely replaced the traditional drawing board at the production information stage. The basic function of CAD tools is allowing the user to build up drawings by manipulating lines, circles, rectangles and texts interactively on the screen. The clear advantage of CAD software is the ability to allow „editing", which means delete, move, copy, rotate, scale, mirror etc. Furthermore, since the drawing can be saved at any stage, the designers are able to keep various versions of the building layout for later study. Once the geometrical information of the building design is stored in a CAD package, different views of the building can easily be produced. Visualization and animation systems, like 3D studio, can produce photorealistic, static and moving images, so that the clients can view the final appearance of the building at the design stage. Virtual reality technology even allows the user to interact with the design model and experience the building in simulated reality settings, including simulated construction sequence.

2. Building Engineering Applications

Nowadays, construction industry clients have ever higher expectations. They want their buildings to look good, to be safe, to provide comfortable living environment for their occupants, to consume less energy in operations, etc. The ever more complex demands on the building design process have given rise to the need for a new approach to building engineering design based on computer software. Once a building is constructed, it is very costly to correct any design defects. It is, therefore, important to simulate accurately the building performance at the design stage so that problems can be identified and solved. Over the years, a variety of methods and algorithms have been developed to predict

building performance in thermal, lighting, acoustics, and structural aspects. Because of the complex and tedious calculation that involve these simulations, it was nearly impossible to carry them out before computers. During the last two decades a range of building engineering applications have been developed for energy analysis, HVAC design, structural analysis, lighting simulation, etc. The benefit of these applications is that they allow designers to evaluate alternative design. Examples of this software are: ATEAN from carrier, and CARGASW from climasoft, that offer comprehensive range of software options for climatic energy design; CALCULUX from lighting and building services design, CYPE INGENIEROS S.A. for structural design, cosmos for finite element analysis, DUCTSIZE from Elite software for electricity and water net design.

3. Microsoft Project

Microsoft Project is project management software that's used to create schedules, project plans, manage resources and keep track of time. It has features such as Gantt charts, kanban boards and project calendars for project management professionals.

4. GanttPRO

GanttPRO is Gantt chart software for efficient project management. It easily allows splitting your projects into groups of tasks and subtasks, organizing and scheduling tasks, and setting durations and dependencies between them. GanttPRO put your projects on Gantt charts to set accurate estimates and manage your resources wisely. GanttPRO online project planning tool has basic Gantt charts features as well as features of the team management software and the resource management software. GanttPRO lets you work alone or create a workspace for your team. Set roles, assign tasks to team members, track

project progress, critical path, Auto Scheduling, cost management, dependencies between tasks, tasks management.

5. BIM 360

BIM 360 is an online project management system designed for construction industry. It is designed to help project, field and BIM managers to speed up the delivery of their projects and manage their project budget and adhering to industry standards, safety rules and project specifications. BIM 360 enables teams to effectively design, implement workable schedules, enhance communications and resolve issues faster. It allows managers to have near absolute control over their projects, resulting faster and more efficiently delivery of their projects. BIM 360 features include; construction tracking, real time data, manage field data, track key performance indicators, dashboards, quality assurance/quality control, access control, navigation, notification, publishing, view filed data update, manage field data performance, design tools integration, document modification, custom reports and analysis, identify trends and minimizes.

6. Acculynx

Acculynx is the specialty trade industry's software designed to help contractors see their business more clearly and communicate better .It is a comprehensive construction estimating program that offers bid management, project scheduling, project management, accounting, service management, and customer relationship management within one cohesive system. Acculynx provides tools to help users manage the job history, from lead to payment. Acculynx ensures that every person in your team is connected and works in synchronization, and that all tasks are planned and well organized. People are given access

to the information they need, which they can reach from just about anywhere using their daily log, documentation management, equipment management, scheduling, custom reports, exportable reports, permission.

7. Jonas Premier

Jonas Premier is a remarkably powerful, beautiful and simple to use cloud construction software for construction companies under the Jonas construction software. It is a simple, modern and powerful software which will automate your entire workflow and discover an easier way to get more profitable jobs. Premier has been designed for all groups of person i.e. General Contractor/Design Build, Construction Management, Land Developer, Home Builder, Civil, Fit-Out or Specialty Contractor All this is provided in one accounting, job cost, project/document/drawing management solution specifically designed to meet the needs of the business. Cloud technology creates a better world for construction - automation and collaboration.

8. Procore

Procore Construction OS connects people, applications, and devices through a unified platform that helps construction firms manage risk and build quality projects, safely, on time, and within budget. Procore has a diversified business model with products for Construction Project Management, Construction Financials, and Quality & Safety. With Procore, the teams can be kept together even if they are not. With the power of mobility teams can view the project from the same perspective while being in different locations. You can untether your teams and ensure they remain connected and communicate effectively from the field to the job site trailer to the corporate office.

9. CoConstruct

CoConstruct is a web-based and mobile construction project management service designed to meet the specific operating needs of clients, builders, and design-build firms. With three well-formulated functionality modules, CoConstruct helps builders and remodelers face common challenges related to their projects, be that budgeting, client communication, scheduling, or activity planning. What makes CoConstruct really specific compared to similar solutions is its unique design that allows management of perpetually changing concepts, instead of limiting constructors' possibilities to defined types of activities, designs, or materials. The development team made this possible by delivering unrestrained customization; and creating a product open for modifications and client, sharing photo and files, budget and forecast project cost, track job site activity and progress, effortless proposals, single entry estimating, track change orders and expenses.

10. Buildertrend

Buildertrend is a Cloud Based Home Building Software for Residential Builders and Remodelers. It provides web-based home builder software to optimize communication between the residential builders, their customers, vendors, and subcontractors. With Buildertrend it is possible to build and collaborate from anywhere with real-time access to plans, punch lists, documents and daily reports. Buildtrend is a web-based system, which means users can access it anywhere via a computer or mobile device. Buildertrend comes with pre-sale tools, such as a built-in CRM system and quick bids and proposals. There are also many project management tools like scheduling, budgeting, and time sheets. Customer management pre-sale process, project management, financial tools, customer management.

11. Knowify

Knowify is an online project management system that enables users to estimate Jobs and track performance. Its features are fully integrated with purchasing and time keeping for real time monitoring against labor and material budgets. Provides built in job costing and it project management tools. Knowify works on both the complex and real time needs of contractors. Knowify features include ,charge orders, contracts and estimates budgetary contractors, job scheduling , task manager warranty management, job costing and estimating bids service work , time tracking scheduling ,purchasing and expenses , personalized PDF outputs , export to spreadsheet customized privileges , email notifications and alert.

12. ProContractor

ProContractor is an all in one comprehensive solution designed to help small and middle size contractors, manage critical financial operations. It provides a solution for estimating, project management and accounting. Pro contractor helps manage the entire project cycle from bid to project completion. ProContractor's features include; accurate accounting, maximum mobile, profitable project management and easy estimating. ProContractor's easy estimating enables you to gain leverage in the construction bidding phase and win projects and also maintain your database to achieve accurate take offs. ProContractor helps masonry and earth work contractors to produce seamless estimates and to manage projects from bidding to accurate accounting, maximum mobile, profitable project management, easy estimating.

13. Plangrid

Plangrid is a Construction productivity software which delivers real-time project information to the people who need it. PlanGrid has the capability to annotate results with the markup tool by marking up your plans with notes and photos, right from the field. These can be shared with your team in real-time. To resolve this punch list even faster, mark up any issues you see directly on the plans. Hyperlink and tap into any contract documents, including RFIs or specs, right from your blueprints after which you can share an RFI. With Plangrid you can generate as built drawings in plangrid which will make document, reporting, enterprise and progress.

14. Projectmate

Projectmates is an online capital construction program management and project management that increases data security and dependability and advances construction management. Projectmates' features include; document management, work flow management, contract management, capital planning, scheduling, bid management, program reporting, project dashboard, and backups & archive. Project mates' document management enables storage, managing and tracking your drawings, documents, photos and other related files that pertain to the construction project. Work flow management allow you to automate your construction field communication with submittals, daily field reports, punch lists and discussions. Project mates' construction contract management enables you to manage accounting by keeping all document management, workflow management, contract management, capital planning, scheduling, bid management, project dashboards, program reporting, backup and archive.

15. eSUB Subcontractor

eSUB Scheduling software allows users to choose the assignment start time, finish time, or the percentage complete for individual assignments. This makes scheduling each specific task completely clear and easy to plan around..eSub combines critical path scheduling tools with the accessibility of cloud based technology, enabling real time updates while in the field or at the office. Delays and lack of schedule coordination can lead to financial losses, but with eSUB Scheduling you can ensure that you get everyone on the same page.eSUB standardizes project management procedures so project managers can easily enter data, site events, labor activities, material costs.

16. Work flow Max

Work flow Max is an online project management system built to take care of all your business management needs including project tracking, timesheets, reporting, invoicing and job monitoring. Work flow Max features include client management, job costing, time tracking, document management, powerful custom and staff scheduling. Work flow Max has every business tools built-in into one solid, compact package. This means you do not need to launch applications from multiple systems, ensuring that you work faster, effectively and efficiently. With Work flow Max all the data can be accessed stored anytime and from anywhere. Work flow Max provides real time data hence transparency and visibility.

17. Site Max

Site Max Systems is a software development company that provides construction solutions for forward thinking companies. With a goal of creating efficiencies by the accurate capture of data via centralized processes. Centralize your workflows and optimize your process.

Make better business decisions by seeing what is happening. Supported by a responsive web application for desktop, tablet or mobile platforms, Site Max ensures all stakeholders are in sync within a collaborative, paperless environment. Introducing an array of Flex Forms, traditional paper documents can be eliminated with customizable layouts and interfaces for processing any number of Site, Safety and Daily Reports.

18. BuildingTools

BuildTools is an online construction management platform that serves anyone involved in the construction or remodelling of a home. BuildTools enables its users to manage all communication needs to the whole team involved in a certain project. Build tools is focused on the custom builder and the remodeler, customer profile, providing flexible and easy solutions that addresses their needs better. It provides a centralized collection of all construction project management communication materials and improving communication in the process. Build tools captures every e-mail, document and photo related to your project with seamless mirroring of your current client communication tools.

19. Radar

Radar is cloud-based construction software that provides intuitive, collaborative tools to manage multiple construction projects from any location, making project tracking easy. Radar centralizes data and standardize processes to keep projects organized and better managed. With Radar the profitability of a project is improved due to its ability to standardize and centralize project information using tools such as RFIs, submittals, contract

and change order management and more. With easy to use tools for managing unlimited projects from any location and built with multi-tier architecture and role based permissions, Radar can be used in a single office or scale to meet the needs of task management, customize documents, requests for information (RFIs), field reporting - delays, issues and more, submittal management, change order management, project library, company and project spec management.

20. Jonas Enterprise

Jonas Enterprise is a fully-integrated construction software solution for everyday life. The job costing module helps to manage, control and improve the profitability of the projects. This job costing construction software is designed to help manage jobs more profitably, more efficiently, and more effectively. The Job Costing module allows for a variety of methods to collect and track job costs, revenue, labor and equipment hours, and materials. The construction management software solution assists contractors in billing for cost plus or management fee work. Users can also set up billing rates for each job, with mark-ups possible at the overall job level.

21. Committed Cost

Committed Cost is an online project cost management software designed to track daily progress reports and construction daily activities. It helps project managers, project sponsors and site inspectors who spend most of their time on the operational elements of projects which demand a fit for purpose project control system. It involves investment that

a business entity has already made and cannot be recovered by any means as well as the obligations to pay a good or service at any future time. Committed Cost features include; accounting management, actual costing, budgeting & forecasting, cost analysis, cost tracking, templates, invoice management, job costing, labour costing.

2.2.2 The benefit for the adoption of computer software by construction companies in management of building project

Software has been shown to be a vital tool in assisting the construction industry to cope with the increasing complexity of its product and services as well as the increasing demands of clients and regulators (Betts,1999), and to enhance construction productivity (Liston et al., 2000).

Web-based software has changed the face of the construction industry. It has increased sales and efficiencies, all the while decreasing costs and keeping teams better connected. Large or small, construction jobs can be made easier with the right support system, especially when it comes to management software. Clear communication and transparent project management between contractors, teams, and management make for a smooth workflow and better bottom lines for all involved.

Below are fifteen benefits to using web-based software, which keeps you and your crews flexible, accurate, and efficient.

1. Flexibility

No matter where a crew is deployed — in the office, the field, or onsite — web-based construction software keeps everyone connected at all times. Typically, all that's needed is a network connection, an app or a web browser, and suddenly you're connected worldwide.

2. Real-Time Communication and Collaboration

Arguably one of the most critical functions of any construction manager is making sure everyone is communicating and collaborating effectively at any given job site. Managing projects as they grow and change is difficult, but for companies that have team members across town or even across the country, it gets even harder to keep everyone on the same page.

With a construction management software system in place, every team member has access to a centralized point of communication no matter where they're working or what device they have on hand—helping ensure real-time communication and collaboration between clients, consultants, contractors, and project managers.

3. Document Management

Given the amount of important documentation construction companies manage, it's no surprise that there's significant pressure to store and handle that documentation securely. With the days of paperwork crammed in filing cabinets long gone, integrating document management into construction management software gives companies a safe place to store all their essential documents. For companies looking to gain a competitive edge, having a secure and easily accessible way to manage documentation is invaluable.

4. Consistent estimating

Web-based construction software can help you increase estimate accuracy and improve the profitability for the work you gain. Detailed take-offs and bids, referencing historical data and experience, calculating the scope of a project and more in an efficient and consistent manner lessens the risk of incurring a loss on the job. Quick, accurate estimates can be a fast and efficient way to grow your business.

5. Accurate job costing

Breaking out job costs allows you to quickly compare actual costs to budgeted costs while a project is in progress, not just after completion. With this up-to-the-minute information, via management construction apps, you can immediately see goals, red flags, and other items, including paid invoices and change orders. Trade publication Construction Business Owner reports that to remain credible with financial partners and bonding agents, contractors must be able to forecast project outcomes, and job costing can be your essential partner in this.

6. Organized work order management

One of the most significant benefits of construction management software, having a comprehensive view of all work orders and the resources available can make or break the structure of a project or construction company. From correctly writing a work order to closing finished orders, web-based software for construction management takes many of the stumbling blocks out of the picture, giving you and your team more time to focus on the tasks at hand.

7. Detailed project tracking and management

Informed and successful project managers help ensure projects stay profitable. A good mix of planning, controlling, and monitoring helps everything run smoothly, with no surprises, no matter how large or small a project. Taking the time to plan and monitor projects will help reduce cost and duration. By setting up procedures and expectations, you can keep tabs on process, timelines, and budget.

8. Comprehensive equipment management

No matter location, project managers can access equipment information and job performance. From location and maintenance history to repair costs, construction equipment management can maximize profit associated with your owned or rented fleet.

9. Quick reporting

With information and metrics at your fingertips, building reports using construction software is an easy step in communicating progress, costs, billing, ROI, and more. It allows you to share information with stakeholders and teams on a regular basis, as well as see where your construction business is heading and how to reach benchmarks and goals along along the way.

10. Customization

At its core, construction management software is highly customizable. This is because there isn't a "standard" template for the features included in a solution. Most construction companies rely on their unique processes, and software companies are usually keen to meet those needs by tailoring their software to the specific needs of their customers. With this in mind, the ability to tailor construction management software to your processes and

requirements can lead to faster deployment and, ultimately, faster growth for your company.

11. Easy Adaptation and Integration

One of the biggest pain points surrounding the adoption of any software solution is how fast it can be adapted and integrated into a company's existing workflows and processes. The faster it can be integrated, the quicker it can be utilized to increase efficiency across an organization. Considering the complexity of the construction industry, construction management software is designed to make it as easy as possible for every user to adopt and integrate it into their processes.

12. Resource Management

Construction management software helps align all the resources and tools utilized in construction and coordinate their application across project timelines. By analyzing resource data, managers can better optimize the tools and resources to fit their initial project bids and estimates. On a more granular level, a CMS can also help contractors manage and organize the day-to-day allocation of tools and equipment, staff, and materials, tracking their use in real-time. Coupled with the ability to compare current and past project data, construction managers have a much more efficient and effective means to coordinate resources.

13. Convenience

It's no secret that every construction manager does things a little differently when it comes to managing their respective projects, but giving them the ability to manage their processes as efficiently as possible can be a game-changer. Take all the manual processes a project

manager has to do daily—calling/emailing contractors, reviewing project timelines, coordinating employee workload—these processes can take up a significant amount of time.

14. Budgeting

Overseeing the scope, schedule, and budget of projects is a top priority of any construction company, but budgeting often requires the most attention. An incorrect budget estimate can see a project overshoot its schedule or remain incomplete. That's why when it comes to budgeting, carefully examining all project plans for risks, creating accurate estimates, and communicating objectives to stakeholders and clients is pivotal. Fortunately, one of the main benefits of construction management software is minimizing costs and maximizing profits through better budget management.

A CMS offers capabilities like automating material and labor costs, standardizing bid proposals, and storing and integrating previous project costs, bids, and win/loss ratios so you can more accurately improve your estimating processes. Moreover, construction management software gives you better visibility into potential risk factors like workloads, change requests, and other factors that can potentially affect your mid-project budget allocation.

15. Project Management

Construction management software makes it easier for managers to adopt an efficient, systematic approach to project management. The best project managers can ensure each team member and the myriad of moving pieces fit into one cohesive puzzle. To this end,

an easy-to-use CMS helps managers instantly share valuable information, track the project budget and create all the necessary components like requests for information, business letters, change requests, and more.

2.2.3 Challenges of the adoption of computer software by construction companies in management of building project

The challenges of adopting computer software for the management of building projects in construction companies are well documented in the literature. These challenges are multifaceted and can have significant implications for project success, cost, and time. The following are some key findings on the challenges of adoption of computer software by construction companies in the management of building projects:

1. Lack of awareness and knowledge: Many construction companies are not aware of the various software available for project management, or may not have the expertise to implement and use them effectively. This can result in missed opportunities for improved efficiency, cost savings, and improved project outcomes. To address this challenge, construction companies need to invest in training and development programs to ensure that their staff is up to date with the latest technology and best practices.

2. Lack of integration: Another challenges is the lack of integration between different software system used in different stages of the building project, which can result in data loss, duplication of efforts, and errors (Sampaio et al., 2021; Zou et al., 2019).

3. Lack of government support: Government policies and regulations may not provide sufficient support for the adoption of computer software in the construction industry. This

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can lead to a lack of incentives for construction companies to invest in software. To address this challenge, governments can provide financial incentives, tax credits, or subsidies to construction companies that adopt software for project management.

4. Cost of implementation: The cost of software, as well as the cost of training and implementing new software, can be a significant challenges for construction companies, especially smaller ones (Wang et. al., 2019).

5. Lack of compatibility: Construction companies must ensure that their existing software is compatible with any new software they are considering. This is especially important for legacy software, as compatibility may be a challenge.

6. Lack of data security: As construction projects involve a great deal of sensitive data, it is important to ensure the safety of any software used. It is essential that the software used is secure and can protect the data from any malicious actors.

7. Data Quality: Data quality is critical in building projects, and there can be challenges in ensuring that the data inputted into software systems is accurate and complete, which can affect decision-making and project outcomes (Chan et. al., 2020; Huynh and Ahmed, 2017).

8. Resistance to change: One of the main challenges of introducing new software of introducing new software in the construction industry is resistance to change from professionals who are used to traditional methods. This can result in a lack of adoption or inefficient use of the software (Jokisalo et al., 2019; Alshawi et al., 2013).

2.3 Review of Related Empirical Studies

Studies have been carried out to determine the critical success factors, the barriers and enablers to ICT application in construction projects to harness the technology and streamline business process in emerging economies. The general problem addressed is what are the critical success factors, (CSFs), and barriers that impact the implementation, adoption, usage and diffusion of ICT in the construction industry? Such a framework should enable identification of at-risk IT projects during the early stages of project evaluation and facilitate formulation of appropriate risk mitigation measures. Ugwu et al (2006) discuss further details on the research. There is an abundance of documented literature that describes various projects in construction, which focus on IT-driven construction process innovation. However, while the majority of the research focuses on developing improved products, process and computational models, there is a noticeable dearth of research that focuses on issues and factors that impinge on the uptake of IT systems in construction, including stakeholders" perceived benefits challenges of computer software in practice Ugwu et al (2006). An adequate understanding of perceived and expected benefits would facilitate an unambiguous understanding of user requirements and subsequent translation into system functional specification during development. Computer software implementation in construction results in significant changes and potential improvements in design and management processes within the organization. It is therefore necessary to investigate critical success factors as well as inhibiting factors.

 Some research in mainstream computing and software development have investigated the socio-technical aspects of systems development and application in organization (Barrow,

1999), Bingi et al (1999), Holland and light (1999), Bourque et al (1999), Hondeshel and Watson (1990), Watson et al (1991), Watson and Frolic (1993). Other researches reported in literature have focused on investigating the various type of different computer software application areas of IT in construction. Such studies have been conducted in Singapore (Hua, 2005), Norway (Samuelsom, 2002) Scandinavia (Howard et al 1998),

New Zealand (Doherty 1997), UK (Egbu & Botterill (2002)), (Ugwu et al 1999). The proliferation of research on IT barometers in construction on national and cross national basis indicates increasing interest to investigate socio-technical aspects of software development and use in the Architectural, Engineering and Construction   (AEC) sector.

The research model was designed to investigate various related questions outlined. The research instrument includes a combination of structured open-ended interviews, questionnaires and evidence based research used for further validation. Several research methods were adopted in the multistage research. The first stage used a combination of pilot questionnaire survey, structured interviews with senior personnel of leading construction organizations, and deductive analysis techniques for interview protocol analysis (Ugwu et al, 2003a). The second stage used a questionnaire-based survey and case-study/evidence-based research techniques.
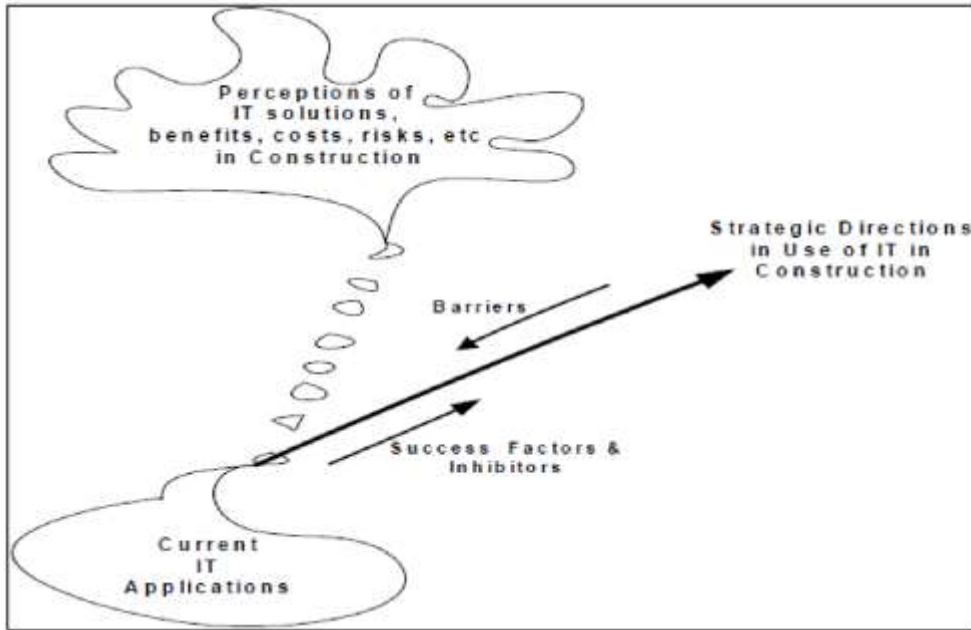
Figure 2.1: Research framework – ICT applications, success factors, barriers, benefits and risks. (Source: Ugwu et al 2007).

Fig.2.1 shows the research model used to investigate the various related questions. The research framework was broad and covered different dimensions of information and communication technology (ICT) in architecture, engineering and construction (AEC) sector. These include; current applications of IT in construction, success and inhibiting factors, perceptions of IT application areas in solving construction problems, and organization strategic directions in IT application.

Ugwu et al (2006, 2007), discussed detailed analysis of the results of research and case study projects that identified the key enablers and barriers to ICT application in construction projects in Hong Kong, and then posited several lessons for emerging economies of which the Nigerian construction industry is one of them. Further analysis of the responses reveals that contractors ranked "Ease of use" and "Change management at

organizational level" as the first and second most significant success factors respectively, while the whole group of respondents collectively rank these as 5 and 6 respectively. Ease of use is a major issue that system developers must address in any ICT project to minimize training requirements and the associated operational cost. Change management is a wider issue to address by the management to ensure that adequate measures are taken to cushion the impact on the work force, often engendered by change in business process that result from introducing ICT systems.

2.4   Summary of Literature Review

The application of computer software in construction project is well revealed. The adoption of computer software in management of building construction project generated new opportunities for construction industries.

The current ICT strategies in construction sector involve computer aided design, building engineering, computer aided cost estimation, planning schedule and sight management is among the element that constituted the road map.

Furthermore current communication technologies for the construction industry supported springing of the tools like E-business commerce, m-commerce, wireless communication, web portal and service oriented architecture.

CHAPTER THREE

3.0   **RESEARCH METHODOLOGY**

The subheading examined include; research design; area of the study; population for the study; sampling and sampling techniques; instrument of data collection, validation of the instrument, reliability of the instrument, method of data collection as well as method of Data analysis

3.1 Research Design

The research design that was used in this study is the survey method, where questionnaires are used to evaluate and gathered information under this study. The descriptive survey is a research which involves the assessment of sampled people's opinion using questions. The survey research design is suitable for this study because the study will seek information from a sample that was drawn from a population using questionnaires.

3.2 Area of the Study

This study was conducted in Ilorin city capital of Kwara State. Kwara is a state in Western Nigeria, bordered to the east by Kogi State, to the north by Niger state, and to the south by Ekiti, Osun, and Oyo states, while its western border makes up part of the international border with Benin Republic. It's capital is the city of Ilorin and the state has 16 local government areas. Of the 36 states of Nigeria, Kwara is the ninth largest in area, but the sixth least populous, with an estimated population of about 3.2 million as at 2016, Location Coordinates 8°30′N 5°00′E, Geopolitical Zone North Central, Date created 27th May 1967, Total area 36,825 km2 (14,218 sq mi).

Geographically, Kwara state is split between the West Sudanian savanna in the west, and the Guinean forest–savanna mosaic ecoregion in the rest of the state. Important geographic features of the state include rivers, with the Niger flowing along the northern border into Lake Jeba, before continuing as the border, while the Awun, Asa, Aluko, and Oyun rivers flow through the interior. In the far northwest of the state is the Borgu section of the Kainji National Park, a large national park that contains populations of grey heron, kob, hippopotamus, African bush elephant, olive baboon, and roan antelope, along with some of the last remaining West African lions on Earth. In the far southwest, a small part of the Old Oyo National Park contains crowned eagle, martial eagle, African buffalo, oribi, and patas monkey populations.

Kwara state has been inhabited for years by various ethnic groups, primarily the majority Yoruba people that live throughout the state, but there are sizeable minorities of Nupe people in the northeast, Bariba (Baatonu) and Busa (Bokobaru) peoples in the west, and a small Fulani population in Ilorin, moving through the state as nomadic herders.

Economically, Kwara state is largely based around agriculture, mainly of coffee, cotton, groundnut, cocoa, oil palm, and kola nut crops. Other key industries are services, especially in the city of Ilorin, and the livestock herding and ranching of cattle, goats, and sheep. Kwara state has the joint-twentieth highest Human Development Index in the country and numerous institutions of tertiary education.

3.3 Population of the study

The targeted population for this study is 80 respondents, which consist of 50 Contractors and 30 Site Engineers

3.4 Sampling of the study

In this study purposive sampling technique will be used. The purpose of purposive sampling is to generate data from a sample that is highly knowledgeable about the topic and can provide rich insight into a particular issue or phenomenon. Purposive sampling is "used to select respondents that are most likely to yield appropriate and useful information. Kelly (2010) and is a way of identifying and selecting cases that will use limited research resources effectively. Palinkas et al (2015). The sampled population is from 50 respondents, whose includes 32 contractors and 18 site engineers currently working in the selected Kwara building construction project.

Table 3.1 Population distribution of Contractor and Site Engineers in Kwara State

S/N	Building Construction	Contractors	Site Engineers
1	Onada Construction Company Nigeria Limited	9	5
2	Crown David Construction	12	7
3	Tostech Construction Company	11	6
	TOTAL	**32**	**18**

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3.5 Instrument of Data Collection

A structured questionnaire was used to collect data for this study. Questionnaire are an instrument designed to get answer to questions by using a form, which the respondents fill by themselves will be utilized. It is less time consuming and wider in terms of coverage. The responses provide data for testing the hypothesis of a study.

The questionnaire for this study was developed by the research and is meant to elicit information from contractors, builders and structural engineers. The questionnaire is made up of four sections A and B. Section A contains the personal information of the respondent. Section B contains the questionnaires items, which are divided into three sub-sections according to the research question, such as research question 1, 2 and 3. All items are to be responded by the indicating the appropriate respondent's best perception using four point scale.

3.6 Validation of the Instrument

The instrument was validated by three lecturers in the department of Industrial and Technology Education, Federal University of Technology Minna. The critiques, suggestions and recommendations of the validators was used to make final corrections on the instrument before it was administered to the respondents.

3.7 Administration of instrument

The instrument used for the study was administered by the researcher personally. He visited some construction companies in Kwara to distribute and collection questionnaires in order

to interview and collect information based on the research study. A total of about 100 questionnaires were distributed.

3.8 Method of Data Collection

The analysis of data for the research question and hypothesis were accomplished using the mean, standard deviation and t-test was used to test the test the hypothesis of two groups of respondents at 0.05 level of significance.

The four rating scale developed is as follows:

High Extent	=	HE	= 4	Strongly Agree	=	SA	= 4
Moderately Extent	=	ME	= 3	Agree	=	A	= 3
Low Extent	=	LE	= 2	Strongly Disagree	=	SD	= 2
Rately	=	R	= 1	Disagree	=	D	= 1

$$X = \frac{\Sigma fx}{N}$$

Where: X = Mean

F = Frequencies of each response opinion

X = Weight of response opinion

N = Number of respondents of the items

The mean of the response option was computed with the formula

$$X = \frac{\Sigma fx}{N}$$

Where: X = Mean

Σ = Summation

Therefore the mean value of the 4 point scale is:

X = 4

$$= \frac{4+3+2+1}{4}$$

$$= \frac{10}{4}$$

$$= 2.5$$

3.9 Decision Rule

The mean of 2.5 was used as decision point for every questionnaire item consequently any item with mean respondent of 2.50 and above was considered to be agreed and any item with response below 2.50 was considered as disagreed. An inferential t-test was used to test the hypothesis at 0.05 level of significance to compare the mean responses of the two groups.

CHAPTER FOUR

4.0   RESULT AND DISCUSSION

4.1   Research Question One

To what extent the management of construction companies are aware of different types

of computer software in management of building project in Kwara State?

Table 4.1 Mean and Standard Deviation of contractors and site engineers on the

extent the management of construction companies are aware of different types of

computer software in management of building project in Kwara State.

$N_1 = 32$ $N_2 = 18$

S/N	Types of Computer Software	X_1	SD_1	X_2	SD_2	X_T	REMARK
1	Computer Aided Design and Visualization	2.43	0.66	3.10	0.89	2.77	Low Extent
2	Building Engineering Applications	2.53	0.60	2.90	0.80	2.72	Low Extent
3	Microsoft Project	2.82	0.78	3.00	0.85	2.71	Low Extent
4	Gantt PRO	2.53	0.80	2.73	0.60	2.63	Low Extent
5	BIM 360	2.45	0.60	2.70	0.65	2.58	Low Extent
6	Acculynx	2.57	0.78	2.67	0.70	2.62	Low Extent
7	Jonas Premier	2.53	0.67	2.70	0.68	2.62	Low Extent
8	Procore	2.65	0.87	2.67	0.80	2.66	Low Extent
9	CoConstruct	2.80	0.68	2.70	0.70	2.75	Low Extent
10	Builder trend	2.40	0.54	2.70	0.65	2.55	Low Extent
11	Knowify	2.55	0.83	2.83	0.70	2.69	Low Extent
12	Pro Contractor	2.67	0.80	2.60	0.54	2.64	Low Extent
13	Plan Grid	2.60	0.76	2.70	0.62	2.65	Low Extent
14	Project mates	2.55	0.80	2.60	0.50	2.58	Low Extent
15	eSUB Subcontractor	2.65	0.87	2.67	0.77	2.66	Low Extent
16	WorkflowMax	2.63	0.80	2.50	1.01	2.57	Low Extent

S/N	ITEMS	X_1	SD_1	X_2	SD_2	X_T	REMARK
17	Site Max	2.65	0.87	2.77	0.54	2.71	Low Extent
18	Build Tools	2.55	0.83	2.47	0.67	2.51	Low Extent
19	Radar	2.88	0.70	2.80	0.87	2.84	Low Extent
20	Jonas Enterprise	2.63	0.80	2.53	0.67	2.58	Low Extent
21	Committed Cost	2.55	0.83	2.60	0.66	2.58	Low Extent

KEY

N_1 = Number of Contractors N_2 = Number of Site engineers

X_1 = Mean of Contractors X_2 = Mean of Site engineers

SD_1 = Standard deviation of Contractors SD_2 = Standard deviation of Site engineers

X_T = Average of Contractors and Site engineers

The data presented in the Table 1 above revealed that both the Contractors and Site engineers are Low extent with all the items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11. 12, 13, 14, 15, 16, 17, 18, 19, 20 and 21 with mean score ranging from 2.51 to 2.91.

4.2   Research Question Two

What are the benefit for the adoption of computer software by construction companies in management of building project in Kwara State?

Table 4.2 Mean and Standard Deviation of contractors and site engineers on the benefit for the adoption of computer software by construction companies in management of building project in Kwara State.

N_1 = 32 N_2 = 18

S/N	ITEMS	X_1	SD_1	X_2	SD_2	X_T	REMARK

1	It Improve organizational and process flexibility	3.48	0.77	3.07	0.87	3.28	Agreed
2	It improve real-time communication and collaboration	3.42	0.83	3.13	0.90	3.28	Agreed
3	It improve document management	3.38	0.87	3.20	0.89	3.29	Agreed
4	It improve consistent estimating	3.40	0.85	3.23	0.86	3.32	Agreed
5	It improve accurate job costing	3.13	0.89	3.03	0.93	3.08	Agreed
6	It improve organized work order management	3.20	0.91	3.07	0.91	3.14	Agreed
7	It improve detailed project tracking and management	3.20	0.94	2.87	0.74	3.04	Agreed
8	It improve comprehensive equipment management	3.23	0.85	2.90	0.82	3.07	Agreed
9	It improve quick reporting	3.38	0.85	3.07	0.97	3.23	Agreed
10	It improve customization	2.98	0.91	2.67	0.52	2.83	Agreed
11	It improve easy adaptation and integration	3.30	0.94	3.13	0.91	3.22	Agreed
12	It improve resource management	3.07	0.97	3.00	0.93	3.04	Agreed
13	It improve convenience	3.23	0.89	2.97	0.85	3.10	Agreed
14	It improve budgeting	3.27	0.88	2.80	0.90	3.04	Agreed
15	It improve project management	3.37	0.76	3.00	0.87	3.19	Agreed

KEY

49

N_1 = Number of Contractors N_2 = Number of Site engineers

X_1 = Mean of Contractors X_2 = Mean of Site engineers

SD_1 = Standard deviation of Contractors SD_2 = Standard deviation of Site engineers

X_T = Average of Contractors and Site engineers

The data presented in the Table 2 above revealed that both the Contractors and Site engineers are Agreed with all the items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11. 12, 13, 14 and 15 with mean score ranging from 2.83 to 3.32.

4.3   Research Question Three

What are the challenges of the adoption of computer software by construction companies in management of building project in Kwara State?

Table 4.3 Mean and Standard Deviation of contractors and site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

N_1 = 32 N_2 = 18

S/N	ITEMS	X_1	SD_1	X_2	SD_2	X_T	REMARK
1	Lack of awareness and knowledge	3.47	0.77	3.57	0.73	3.52	Agreed
2	Lack of integration	3.10	0.90	3.33	0.84	3.22	Agreed
3	Lack of government support	3.37	0.90	3.47	0.82	3.42	Agreed
4	Cost of implementation	3.12	0.94	3.27	0.83	3.20	Agreed
5	Lack of compatibility	3.25	0.90	3.27	0.98	3.26	Agreed
6	Lack of data security	3.30	0.87	3.37	0.89	3.34	Agreed
7	Data Quality	3.40	0.74	3.33	0.80	3.37	Agreed
8	Resistance to change	3.32	0.77	3.43	0.70	3.38	Agreed

KEY

N_1 = Number of Contractors N_2 = Number of Site engineers

X_1 = Mean of Contractors X_2 = Mean of Site engineers

SD_1 = Standard deviation of Contractors SD_2 = Standard deviation of Site engineers

X_T = Average of Contractors and Site engineers

The data presented in the Table 3 above revealed that both the Contractors and Site engineers are Agreed with all the items 1, 2, 3, 4, 5, 6, 7 and 8 with mean score ranging from 3.20 to 3.52.

4.4   Hypothesis One

There is no significant difference between the mean responses of contractors and the site engineers on the awareness of different types of computer software application available for management of building project in Kwara State.

Table 4.4 t-test Analysis of Mean Difference between Responses of Contractors and the Site engineers on the awareness of different types of computer software application available for management of building project in Kwara State.

N_1 = 32 N_2 = 18

	N	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval for Difference	
								Lower	Upper
Contractor	32	0.47	1.65	48	0.52	0.09	0.14	0.18	0.36
Site Engineer	18		1.66		0.52	0.09	0.14	0.18	0.36

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Table 4.4 shows the t-test analysis of differences in the responses of Contractors and the Site engineers on the awareness of different types of computer software application available for management of building project in Kwara State. The Table reveals that the significant criterion (sig. 2-tailed) was found to be 0.52 which is greater than the probability value of 0.05 in comparison. The null hypothesis was therefore accepted. Therefore, there was no significant difference between the mean responses of contractors and the site engineers on the awareness of different types of computer software application available for management of building project in Kwara State.

4.5   Hypothesis Two

There is no significant difference between the mean responses of Contractors and the Site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

Table 4.5 t-test Analysis of Mean Difference between Responses of Contractors and the Site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

$N_1 = 32$ $N_2 = 18$

	N	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval for Difference	
								Lower	Upper
Contractor	32	0.44	1.05	48	0.30	0.17	0.16	0.59	0.49

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Site Engineer	18	1.06	0.30	0.17	0.16	0.61	0.49

Table 4.5 shows the t-test analysis of differences in the responses of Contractors and the Site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State. The Table displays that the significant criterion (sig. 2-tailed) was found to be 0.30 which is greater than the probability value of 0.05 in comparison. The null hypothesis was therefore accepted. Therefore, there is no significant difference between the mean responses of contractors and the site engineers on the challenges of the adoption of computer software by construction companies in management of building project in Kwara State.

4.6 Findings of the study

1. Findings on the extent to which management of construction companies are aware of different type's computer software in management of building project contained in Table 4.1 revealed the awareness of the types of computer software which are Computer Aided Design and Visualization, Building Engineering Applications , Microsoft Project, Gantt PRO, BIM 360, Acculynx, Jonas Premier, Procore, CoConstruct, Builder trend, Knowify, Pro Contractor, Plan Grid, Project mates, eSUB Subcontractor, WorkflowMax, Site Max, Build Tools, Radar, Jonas Enterprise and Committed Cost.

2. Finding on the benefit for the adoption of computer software by construction companies in management of building project contained in Table 4.2 showed that it improved real-time communication and collaboration, improved document

management, improved consistent estimating, improved accurate job costing, improved organized work order management, improved detailed project tracking and management, improved comprehensive equipment management, improved quick reporting, improved customization, improved easy adaptation and integration, improved resource management, improved convenience, improved budgeting, improved project management.

3. Finding on the challenges of the adoption of computer software by construction companies in management of building project contained in Table 4.3 revealed that lack of awareness and knowledge, technical issues, lack of data security, cost of implementation, resistance to change, lack of expertise, lack of government support, lack of compatibility.

4. There is no significance difference in the respondents' response as regarding the awareness of different types of computer software application available for management of building project.

5. There is no significance difference in the respondents' response as regarding the challenges of the adoption of computer software by construction companies in management of building project.

4.7   DISCUSSION OF FINDINGS

Contained in Table 4.1 is the outcome of the respondents the extent to which management of construction companies are aware of different type's computer software in management of building project in Kwara State. The outcome of the findings revealed that Computer

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Aided Design and Visualization, Building Engineering Applications , Microsoft Project, Gantt PRO, BIM 360, Acculynx, Jonas Premier, Procore, CoConstruct, Builder trend, Knowify, Pro Contractor, Plan Grid, Project mates, eSUB Subcontractor, WorkflowMax, Site Max, Build Tools, Radar, Jonas Enterprise and Committed Cost are the types of software can vary among professionals in the building construction which they are commonly used in design and construction processes. However, awareness of the types of software, such as building performance analysis and facility management's software, may be more limited.

Contained in Table 4.2 is the benefit for the adoption of computer software by construction companies in management of building project in Kwara State. The result of this research question revealed that the adoption of computer software by construction companies can bring significant benefits in managing building projects, including improved real-time communication and collaboration, improved document management, improved consistent estimating, improved accurate job costing, improved organized work order management, improved detailed project tracking and management, improved comprehensive equipment management, improved quick reporting, improved customization, improved easy adaptation and integration, improved resource management, improved convenience, improved budgeting, improved project management.

Contained in Table 4.3 is the challenges of the adoption of computer software by construction companies in management of building project. The outcome of the finding shows the challenges which are lack of awareness and knowledge, technical issues, lack of

data security, cost of implementation, resistance to change, lack of expertise, lack of government support, lack of compatibility. The challenges as software adoption must be addressed through a collaborative effort from various stakeholders, including construction companies, software providers, and government agencies

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1   Summary

This study assesses the impact of application of computer software in management of building construction project in Kwara State. The specific objective of the study sought to:

1. Ascertain the awareness of different types of computer software application available for management of building project in Kwara State.

2. Determine the benefit for the adoption of computer software by construction companies in management of building project in Kwara State.

3. Find out the challenges of the adoption of computer software by construction companies in management of building project in Kwara State

In order to achieve these objectives three research questions and two hypotheses guided the study. The research questions were formulated to achieve the study which are the types of computer software, the benefit for the adoption of computer software and the challenges of the adoption of computer software. Research questions were answered using mean and standard deviation. A mean of 2.50 is set for data reporting. Any question item with mean 2.50 and above is regarded accepted while below 2.50 is rejected whereas the two formulated hypotheses were tested using t-test analysis.

Descriptive survey design was adopted for the study. Sample size for the study was 50 respondents comprising of 32 contractors and 18 site engineers. Instrument for data collection was a questionnaire titled Application of computer software in management of Building construction project in Kwara State, the questionnaire was based on 4 point rating scale.

5.2   Implication of the study

This study has implication on both contractors and future researchers. The contractors involved in construction building projects in Kwara State can use this research as a guideline to identify types of computer software, benefit and challenges of the adoption of using computer software in management of building construction. Moreover the contractors can be more informed about direct and indirect benefit. Hence this gives the contractors opportunity to develop interest in the process, thereby this can improve the project delivery of building projects implemented. Future researcher can use the computer software application process the types and the challenges in this study to compare it with different context. This study will be contribution to the limited body of knowledge on construction field and can further open more doors for new areas to investigate.

5.3   Contribution of Knowledge

1. The findings will contribute to builder's experience as the study will generate a list of benefit of the adoption of computer software in management of building construction that can be used as a benchmark to control the existing and future sites.

In addition to this how the benefit are related to the adoption of the computer software will give the builders to be more cautious.

2. Apart from this research being useful to the field professionals, this study will be valuable for the academicians too. As this study will serve as a support of what about computer software application in building construction project.

5.4   Conclusion

Based on the findings of the study which where empirically evaluated this study therefore conclude that the Nigerian construction company have a lot of benefit derive as a result of computer software of the adoption in management of building construction. Infact the future prospect of computer software implementation by the Nigeria construction industry is encouraging as most constructions organization are genially motivated to adopt computer software due to its strategic benefit, tactical benefit as well as operational benefit.

Furthermore base on the survey it is concluded that adoption of computer software in management of building construction project by construction companies, gives a competitive age over those that are yet to be adopted. Also the construction companies would be more able to satisfy the need of their client as the result of software adoption.

The adoption of computer software by construction companies in management of building project may be hindered by certain complication. Such as challenges of training and retraining of IT staff, challenges of hardware purchases as well as maintenance. It is expected that these results will guide policy makers in Nigeria to identify where to

concentrate their efforts to promote increased use of computer software, especially in the construction industry. Also, for the construction in a developing country such as Nigeria to maximize the returns on investment in computer software, it must go beyond basic application like design and programming software to more technical business allocation like, e-business, electronic data management, e-tendering, web base project management, and other advanced software applications. It is also hoped that this study will be repeated in the next few years to measure any quantitative and qualitative improvements in computer software diffusion in the Nigerian construction industry.

5.5 Recommendations

The following recommendation were made for implementation based on the findings of this study;

- Introduce rigorous sectoral software skills training, networking and advocacy for involvement of industry stakeholders.

- Engage in more regional collaboration for information exchange on competitive bidding processes and sustainable local contractor development programs.

- Lobby for increase in Government funding for training due to the absence of legal framework for skills development fund and perceived donor fatigue in capacity building support.

- Improve industry – schools links (e.g. construction clubs).

- Increase opportunities for more private trainers to participate in software training and credentialing.

- Improving the attractiveness of the industry through rigorous advocacy for construction sector Research and Development (R & Ds).

It is expected that Research and Development (R & D) will continue to drive progress in several aspects. Examples of areas that R & D should address in the short and medium terms are:

1. Education (teaching and learning)

2. Interoperability and systems integration

3. User requirement capture

4. Application of complexity and chaos theories as an underpinning framework to investigate the socio-technical dimension of software implementation

5. Adoption and diffusion in construction organizations

6. Standardization e.g. using eXtensible Markup Language (XML) solutions. As a general recommendation, there is need for further research on this subject to elicit more evidence from a larger sample.

Finally, in line with attaining the national vision of becoming one of the twenty largest economics in the world by the year 2020, a viable construction sector which utilizes

software's to global competitive threshold is an imperative. If the construction companies in Nigeria must hold to theirs as regards construction and also be competitive in bidding for international construction contracts, the software paradigm is inevitable.

5.6   Suggestion for further study

The following areas for further study were also suggested;

1. Comparative study on the computer software in construction industry by indigenous and foreign companies

2. Accessing the role of consultant in the usage of building project computer software in Niger State.

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APPENDIX I

QUESTIONAIRIE

IMPACT OF APPLICATION OF COMPUTER SOFTWARE IN MANAGEMENT OF BUILDING CONSTRUCTION PROJECT IN KWARA STATE

Instruction: I am an undergraduate student from the department of Industrial and Technology Education, Federal University of Technology; Minna. Conducting research on Impact of application of computer software in Management of building construction project in Kwara State.

Please help in filling the questions by ticking ($\sqrt{}$) appropriately, the information given will be used for confidential purpose using the response rating scale as follows;

PERSONAL DATA

Contractor ☐

Site Engineers ☐

High Extent	=	HE	= 4	Strongly Agree	=	SA	= 4
Moderately Extent	=	ME	= 3	Agree	=	A	= 3
Low Extent	=	LE	= 2	Strongly Disagree	=	SD	= 2
Rately	=	R	= 1	Disagree	=	D	= 1

RESEARCH QUESTION I

To what extent the management of construction companies are aware of different types of computer software in management of building project in Kwara State?

S/N	The extent to which management of construction companies are aware of different types computer software in management of building project	HE	ME	LE	R
1	Computer Aided Design and Visualization				
2	Building Engineering Applications				
3	Microsoft Project				
4	Gantt PRO				
5	BIM 360				
6	Acculynx				
7	Jonas Premier				
8	Procore				
9	CoConstruct				
10	Builder trend				
11	Knowify				
12	Pro Contractor				
13	Plan Grid				
14	Project mates				
15	eSUB Subcontractor				
16	WorkflowMax				
17	Site Max				
18	Build Tools				
19	Radar				
20	Jonas Enterprise				
21	Committed Cost				

RESEARCH QUESTION II

What are the benefit for the adoption of computer software by construction companies in management of building project in Kwara State?

S/N	The benefit for the adoption of computer software by construction companies in management of building project	SA	A	SD	D
1	It Improve organizational and process flexibility				
2	It improve real-time communication and collaboration				
3	It improve document management				
4	It improve consistent estimating				
5	It improve accurate job costing				
6	It improve organized work order management				
7	It improve detailed project tracking and management				
8	It improve comprehensive equipment management				
9	It improve quick reporting				
10	It improve customization				
11	It improve easy adaptation and integration				
12	It improve resource management				
13	It improve convenience				
14	It improve budgeting				
15	It improve project management				

RESEARCH QUESTION III

What are the challenges of the adoption of computer software by construction companies in management of building project in Kwara State?

S/N	The challenges of the adoption of computer software by construction companies in management of building project	SA	A	SD	D
1	Lack of awareness and knowledge				
2	Lack of integration				
3	Lack of government support				
4	Cost of implementation				
5	Lack of compatibility				
6	Lack of data security				
7	Data Quality				
8	Resistance to change				

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APPENDIX II

REQUEST LETTER TO VALIDATORS

</div>

Industrial and Technology Education Department
Federal University of Technology,
P.M.B. 65,
Minna,
9th January, 2023.

Dear Sir,

REQUEST FOR FACE VALIDATION OF INSTRUMENT FOR IMPACT OF APPLICATION OF COMPUTER SOFTWARE IN MANAGEMENT OF BUILDING CONSTRUCTION PROJECT IN KWARA STATE

I am an undergraduate student of the above named address currently undertaking a study on the topic: IMPACT OF APPLICATION OF COMPUTER SOFTWARE IN MANAGEMENT OF BUILDING CONSTRUCTION PROJECT IN KWARA STATE.

Attached is the draft copy of the instrument. As an expert in this area, your assistance is hereby solicited to enable me accomplish this task. Kindly go through the item to verify their clarity, relevance and appropriateness in the use of language. In addition to this you can also make further suggestions that will improve the status and quality of the instrument. Your contribution to this work is highly appreciated.

Thanks

Yours faithfully,

ADELEKE DAVID ADESOJI
2016/1/63731TI