KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA

# Extent of Use of Computer-Aided Project Planning and Control Systems in the Ghanaian Construction Industry

by

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MASTER OF SCIENCE

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## DECLARATION

I hereby declare that this submission is my own work towards the MSc. Construction Management and that, to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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## ABSTRACT

The scope of infrastructure development is growing larger and more complex as time goes on making the various resource inputs – human, material and plants and machinery – required for their successful completion large as well. It is therefore essential that the entire process be properly planned and controlled in order to ensure this. Computer-Aided Project Planning and Control Systems (CAPPCS), software, provides the various mechanisms for the effective coalition of all the resources required for the planning and control of projects. This in turn serves as the basis for management decisions that ultimately leads to the success of projects. This research was aimed at determining the extent of use of CAPPCS in the Ghanaian construction industry. A descriptive survey was used to solicit information from professionals in the industry. This was done through self-administered questionnaires. The survey population was made up of professionals from construction consulting and professionals working with D1 construction organisations in Ghana. The data garnered was analysed using descriptive statistics, a quantitative approach. The findings of this research indicated a general awareness and use of CAPPCS by the respondents and the organisations that they worked for. The use was however limited to basic scheduling functions. It was evident that more needs to be done in terms of training and sensitising of professionals on the use of CAPPCS.

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## DEDICATION

I dedicate this work to my family - especially my mother Mad. Beatrice Yandoh - for their immense contribution and support towards the success of my education.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

Construction projects are becoming increasingly complex. Developments now require the input of huge resources - human, material, plants and machinery, if they are to be successful. Effective planning and control is therefore essential if the various resources are to be properly allocated, made use of and optimised. Over the years, in the construction industry, this has been executed mostly through manual means. Kim et al. (2013) suggests this approach for managing and controlling projects is considered unreliable and not effective.

This manual and increasingly quasi-automated means of planning and controlling projects within the construction industry poses some challenges to the project manager; especially when they are not proactively and effectively managed. Time and effort which could have otherwise be used in achieving other project deliverables has to be now spent repeating tasks and rechecking activities. Also important information that could help in effective and timely decision making may be omitted or incorporated in the programme at a time that renders it useless insofar as safeguarding the project from negative impacts is concerned. Managers and decision makers are now using information management systems and tools to bring up the levels of project management efficiency and control and to also increase the chances of achieving project objectives.

A combination of techniques, tools and systems for the gathering of project data and its analyses in order to help in the making of choices for efficient project execution known as Project Management Information Systems (PMIS) - a subset of which is computer-aided project planning and control systems (CAPPCS) - helps managers to do this in the construction industry. Through PMIS, the stage is set for the correct amalgamation of the various project aspects – processes, tools, resources and techniques - to shape a system of information which can then be used for the effective management of the project by the various stakeholders which then leads to the achievement set-out project objectives and thus project success.

From the different forms of keeping records, information systems have evolved into complex corporate systems such as Enterprise Business Solution systems. According to Ahlemann (2009), project management information systems have also evolved from just focusing on the project scheduling and sometimes resource management to becoming comprehensive systems that support projects through their entire life cycles and even entire project portfolios.

Information systems play vital roles and these roles as posited by O'Brien and Marakas (2010) are listed below:

- Provision of support to business processes and operations.
- Provision of support to decisions made by management and employees.
- Provision of support to approaches that lead to competitive advantages.

Extending this, project management information systems helps in project execution by providing:

- Support activities required for project progress.
- Support for decisions made by the various stakeholders of the project.
- Support for the proper planning and control of the project to meet set targets.

Despite the various benefits of the successful deployment and use of information systems in the running of projects, the use of such systems in the Ghanaian construction industry, from casual observation, is seemingly limited. Though several factors may be deterring its use, the final cost to projects and the total failure of some project as due to the actions of stakeholders, arising from the absence of clarity of project linkages and dependencies makes this a worthwhile undertaking. The incorporation of project information systems in project execution will enable project participants to have greater visibility of project variables and make informed decisions on the proper application of project resources to ensure that projects are successful.

This paper will seek to find out the extent of the use of computer aided project planning and control systems in the construction industry of Ghana. This dissertation will seek to establish how widespread the use of computer aided project planning and control systems is in the Ghanaian construction industry. In addition, it will seek to establish which of the software among the suite of computer programmes available is mostly used. Furthermore, this paper will explore which of the tools available in the software are usually used.

## 1.2 Problem Statement

Hillebrandt (2000) argues that the construction industry of any given country is a major economic sector of that country. This is because of its outputs and the numerous interdependencies of the outcomes of the activities that lead to those outputs. This is supported by Ofori (2012) who asserts that "it contributes to national socio-economic development by providing the buildings which are used in the production of all goods in the economy. Moreover, the physical infrastructure, built through construction activity, is the nation's economic backbone as it forms the arteries for the facilitation of productive activity by enabling goods and services to be distributed within and outside the country". The inference from this is that the outputs of construction activities serve as inputs for other productive activities in any given economy. This therefore establishes a correlation between the delivery of construction activities and the downstream activities that benefit from their outputs.

In reviewing project management standards in the mass housing branch of the construction industry in Ghana, Ahadzie and Amoa-Mensah (2010) established that "managerial inefficiencies have consistently been a major problem confronting stakeholders in the Ghanaian house building industry" even though "project management practices in the construction industry emerged around the late 1980s when it was first used in Mass Housing Building Production (MHBPs) by a quasi-government organization, Social Security and National Insurance Trust (SSNIT)". This is supported by research carried out by Kissi et al. (2014) who found out from their research that there has not being improvements in the standards of the management of projects with regards to its growth

and widespread adaptation particularly at a time when project management is thought to be a key component in achieving project success.

Like most major industries, improvement in technology has been singled out as one of the essential units for the development of the construction industry. According to CIDB, Malaysia (2007) when developing the construction aspect of the master plan for Malaysia for the period between 2006 and 2015, the extensive use of information and communication technology was designated as one of the strategies that could aid in project success.

The purpose of this dissertation is to establish the extent of the use of computer aided project planning and control systems in the Ghanaian construction industry.

### 1.3 Aim and Objectives

This dissertation seeks to explore the use of software – computer-aided project planning and control systems (CAPPCS) – in project planning and control in the Ghanaian construction industry.

The following are the objectives:

- To determine respondents awareness of CAPPCS.
- To determine the extent of use of software – computer-aided project planning and control systems - in project planning and control in the Ghanaian construction industry.

- To identify factors mitigating their use, if any.
- To identify the components of the various software – computer-aided project planning and control systems - that are usually used.

### 1.4 Justification

Project management is receiving recognition in the country and for that matter in the construction industry as well. This recognition is in some way as a result of the use of the term of "project manager" in the Public Procurement Act (Act 663, 2003) (Kissi et al., 2014). Despite the strides being made, the profession of project management and by extension construction management is besieged by constraints that leave project stakeholders less than satisfied with the outcomes of projects. This is exemplified by the African Development Bank's assessment of the bank's project from 1996 to 2004. The conclusion was that projects were run in an inefficient manner resulting in cost overruns and delays which were significant (AFDB, 2006).

This dissertation is significant because it assesses the appreciation of construction professionals of the need for an effective and integrated project planning and control system in the construction industry. Finally, the subject matter will contribute to the body of knowledge on the Ghanaian construction industry by filling the identified knowledge gap.

## 1.5 Scope

This dissertation is seeks to find out the extent of use of computer-aided project planning and control systems in the Ghanaian construction industry. The focus of this dissertation will be limited to construction consulting professionals and a sampling of professionals working for D1 class of building contractors as classified by the Ministry of Water Resources, Works and Housing (MWRWH) operating in the city of Accra. This is because the majority of building construction in Ghana is being undertaken in this area of the country and by this category of professionals.

## 1.6 Methodology

This research was carried out chiefly through the administration of a well-structured questionnaire that was drawn up as a direct result of the review of literature and an analysis of data available on the subject at hand. A quantitative approach was then used to evaluate and analyse the data collected with respect to the extent of use of computer aided project planning and control systems in the context of the Ghanaian construction industry.

## 1.7 Organisation

This dissertation is organised into five chapters. Chapter One is the introduction which spells out the background of the study along with the aims and objectives. Also covered in Chapter One are the justification and the scope of the study.

Chapter Two examines the literature currently available on the topic and the various theories pertaining to it as well.

Chapter Three supplies the specifics of the methodology used in carrying out this research and also details this research's limitations.

Chapter Four presents the research findings along with the analysis and interpretation of the results. Graphics are used to present to better present the data collected.

Chapter Five outlines the research findings and the conclusions drawn from them along with recommendations.

### 1.8 Limitation of the Research

There are a couple of limitations on the research that may restrict how applicable its findings thereof might be. The statistical method used in the analysis of the results is descriptive statistics as this gives a much simpler interpretation of results. Also, the study covers only a spectrum of construction professionals and companies as the survey was limited to construction consulting professionals and professionals working for D1 construction firms in Accra, and as such may not represent the true picture of the entire construction industry of Ghana.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Before a study of the extent of use of software – computer-aided project planning and control systems (CAPPCS) - in project planning and control in the Ghanaian construction industry can be done, the review of literature related to the following has to be carried out as they have a bearing on the subject at hand:

- Construction/Project management as a professional field of expertise
- Construction/ Project management in Ghana
- Factors responsible for project success
- Computer-Aided Project Planning and Control Systems (CAPPCS)
- Challenges in the adaptation and use of CAPPCS
- CAPPCS and the Ghanaian construction industry.

## 2.2 Construction/ Project Management

From the construction of the first human dwellings to the great pyramids of Giza in 2500BC through to that of the Hagia Sophia from 532AD to 537AD to the present day, evidence exist to support the notion that construction project management has always being a part of construction. (Kozak-Holland, 2011).

The practice of modern project management has its foundations in the infrastructure and technological developments that took place immediately following the Second World War. Morris (1994) asserts that the birth of modern project management is widely assumed to have been firmly allied to the following developments:

- The advancement of engineering systems in the United States aerospace and defence industries and also in the management of engineering in the processing industry.
- The increase in management theory especially in the ways teams were designed and built.
- The evolution of the personal computer.

This is further elaborated by Kerzner (2013) who points out that developments in project management as related to the defence and aerospace industries, after the Second World War, was borne out of the need to have projects delivered in a timely integrated way with only one accountable entity. The use therefore of a project manager with its associated practice of project management became obligatory for defence and aeronautic projects, which required standardization, chiefly when process planning and the manner of reporting information.

A couple of decades after this saw the growth of diverse and essential project management concepts and tools that became the building blocks for modern project management. The Critical Path Method (CPM), Earned Value Management (EVM), the Work Breakdown Structure (WBS), Precedence Diagramming Method (PDM), and The Program Evaluation

and Review Technique (PERT) are some the tools and concepts developed (Stretton, 1993).

Another development that led to the evolution of project management as a discipline is the arrival of modern computing systems and its associated technological innovations (Morris, 1994). The evolution of computing systems along with the creation of the internet has altered the way entities do business by making it more easier to be customer oriented and productive. For the project managers, the acceptance and use of technology in the form of the internet computing systems has given rise to a more effective management and control of the various facets of projects (Kwak, 2005).

In today's globalised world, any company that wants to make the most of the benefits to be gotten from projects thus remain profitable and sustainable must innovate and meliorate their processes. Therefore, an integrated effective project management that makes use of information systems will be a factor in accomplishing this.

### 2.3 Construction/ Project Management in Ghana

There are many challenges facing the Ghanaian construction industry. Of these, poor managerial practices including a shortfall in project management knowledge and standards has been identified as a critical one. Ahadzie and Amoa-Mensah (2010) found out from their research of project management standards in the Ghanaian mass housing sector of that inefficient management has steadily been a big issue confronting stakeholders. This is buttressed by findings from Ofori (2013) which states that "in fact a

lack of adequate empirical studies on the success or otherwise of project management in Ghana in itself has left a documentation gap on the best practices in that area… Until recently, project management was not taught in schools in Ghana. Rather, technocrats who were thrust into managing projects had to learn from their experiences or through working with project management professionals".

Projects continue to fail even though the level of project management cognisance and the acknowledgement of standards and knowledge sharing among professionals is increasing. In order to arrest this situation, professional maturity of project managers is required (Ofori and Deffor, 2013). They define this maturity as the increasing advancement of an organisation-wide approach to managing projects with regards to methodology, strategy, and decision-making process. This definition acknowledges that professional maturity is continual.

As stated earlier, there is evidence to suggest that the practice of project management in the Ghanaian construction industry materialised around the late 1980s. It was during this period that it was utilised in Mass Housing Building Production by the Social Security and National Insurance Trust (SSNIT). This notwithstanding, there has not been any progress especially in terms of its distribution and use at a time when project management is thought to be an important management construct in attaining project success (Kissi et al., 2014).

## 2.4 Factors Responsible for Project Success

Since the coming out and growth of the modern project management, project success as a subject under project management has received a considerable amount of study. This notwithstanding, there are some variances as to what as to makes up project success seeing as project success subjective – different project stakeholders define project success differently. However, there is a general agreement that the subject matter be grouped into two (2) main factions. These are Project Management success and Project Success as prescribed by De Wit (1988) who was a pioneering researcher of the above. In his research he pointed out that in any discourse on the success of a project, an effort must be made to differentiate between the two different factions whilst acknowledging that successful project management can contribute towards project success but is unlikely to forestall project failure.

Research by Meredith and Mantel Jr. (2011) indicates that the success of project management, the result of the effort of the entire project team, is most often targeted at achieving the triple constrains of time, cost and quality parameters. These three indicators are considered the utmost aims of almost all projects as almost always, the target is to deliver the project on time, within set cost and to a set-out requirements.

These same authors also posit that the constraints of time, cost and quality is increasingly being replaced by a new school of thought which advocates the addition of another constraint: client satisfaction. This means that for a project to be successful, it should satisfy the needs of the intended user. The implication of this is that the conventional

parameters of cost, time and quality within which project success or otherwise is assessed does not assure overall project success. This places an important restraint on the project team. De Wit (1988) posits that this situation could make an objective measurement of project success a fantasy, seeing as the numerous objectives of the different stakeholders throughout the entire project life cycle and the varying management levels will have to be taken into consideration. Wateridge (1995) argues that the ambiguities that come up when defining project success calls for a clear outlining and agreement to by all project parties of the standards for accomplishment and the various items that need to be used in the attainment of success at the project outset and this should be revised as the project advances.

Seeing as the issues of time and cost are essential in ensuring project success, it is imperative that all effort must be made to ensure that these constraints are met. The use of software – computer-aided project planning and control systems - which streamlines the linked activities required for proper project planning and control is therefore essential. It is in the light of this that a review of literature on the existing software – computer-aided project planning and control systems – used for project planning and control needs to be carried out.

### 2.5 Computer Aided Project Planning and Control System

Computer-Aided Project Planning and Control Systems (CAPPCS) is a computing system that aids the construction/ project manager in the planning and control of projects. The aim of CAPPCS is to automate, organize and help provide control of project planning and

control processes. Construction professionals are bombarded with information all day long. Construction sites are often not properly equipped to handle the day-to-day paper work that are generated on site. The management of modern construction infrastructural projects is unthinkable without a reliable systematic approach that aids in the organisation, scheduling and control of the work. Computer-Aided Project Planning and Control Systems, which is a subset of Project Management Information System (PMIS), achieves this by furnishing the means to define, exchange, and manage information on the scope of a project, as well as the cost, schedule, and resources. The use of CAPPCS helps the Project Manager to gauge the health and status of whatever projects that may be ongoing while allowing for effective collaboration with other project stakeholders across all systems. In addition to this, it provides a centralised yet accessible archive for managing project information. (Chesley et al., 2014)

The world is becoming increasingly globalised with companies undertaking projects that are essential to their profit margins and sometimes business continuity. (Raymond and Bergeron, 2008). Technology is changing the way projects are executed. Organisations are investing in these technological systems in order to better optimise and achieve customer service, improve operational excellence and decision making and to gain a competitive edge (Laudon and Laudon, 2011).

Construction management, as practiced over the years has been carried out in a manner requiring members of the project team to convene whenever issues needed addressing. The complex and very often large sizes of projects these days make this approach unrealistic. This has increasingly led to the use of advanced telecommunication and

computing technologies in the planning and execution of projects to ensure project success (Meredith and Mantel Jr., 2011).

The Computer-Aided Project Planning and Control Systems employed in the planning and control of projects needs to be adjustable to the complexity, scope and the stage of project on which it is being used along with the various needs and demands of the project participants. The careful study of these needs in order to establish and deploy a system that better serves the needs of the project and its stakeholders is consequently essential. The design of systems should be such that users and project participants who oftentimes have differing needs, can get their needs met whilst accessing the same data. (Buttrick, 2005).

### 2.5.1 Forms of Computer-Aided Project Planning and Control Systems

There are three major forms of Computer-Aided Project Planning and Control Systems. The differentiation is in mostly in the system components and the volume of data that these systems are able to handle effectively. The first of these systems is the integrated systems that encompass all aspects of the project including scope, cost, schedule and resource availability and usage. The second form is a sub-system which usually involves only certain aspects of construction management such as schedule and cost only. The final form of CAPPCS is the isolated system. These systems deal with only a single aspect of project management such as cost only, resource only etc. All of these forms however fall under two broad categories: stand-alone or desktop systems or web based systems. (Suhanic, 2001).

#### *2.5.1.1 Desktop Systems*

These are the systems that are deployed as a programmes that run on the desktop of each user. These types of systems usually give the most responsive and graphically-intensive styles of interface and are capable of handling higher data inputs. Desktop systems are usually single user systems requiring that one stakeholder sign out in order for another to use the same system. In addition, desktop systems store their data in a file on the desktop or increasingly, in the cloud as this makes the accessing and sharing of information seamless (Kumar and Rajak, 2015).

#### *2.5.1.2 Web-based Systems*

Web-based systems are implemented as web applications that can only be accessed the internet by using a web browser. These systems have the advantage of being accessible from different computers without the need for installing the software. This means that it is much more multiple-user friendly than desktop systems. However, the system capabilities are limited and cannot be accessed once the user is offline (Kumar and Rajak, 2015).

### 2.5.2 Components of Computer-Aided Project Planning and Control Systems

There are several components of to a CAPPCS. The number of component is usually determined by the form of Computer-Aided Project Planning and Control System chosen. There are however a number of components that are common to the various forms of CAPPCS. These components are essential to the workings of the various CAPPCS

(Clements and Gido, 2008). The following are the essential components of an integrated Computer-Aided Project Planning and Control System:

- Work Scheduling
- Resource Management (Loading and Levelling)
- Tracking of Activities
- Cost Control

### 2.5.3 Computer-Aided Project Planning and Control Systems and Project Success

Computer-Aided Project Planning and Control Systems is a critical tool that construction managers should have at their disposal if they are to manage projects successfully and achieve project success. The results of a research carried out by Borštnar and Pucihar (2014) suggest that the use of a computing system known as 4PM in support of multiple project management led to improvements in both human and financial resource management in a cooperative and lucid way. Raymond & Bergeron (2008) also concluded from their research on the effect of computer-aided project management systems on project managers and project success that the use of computer-aided systems is beneficial to project managers as it gives rise to upgrades in effectiveness and drives efficiency. This then led to overall affirmative impacts on performance of projects by advancing budgetary control, achieving project deadlines as well as the fulfilment of technical specifications. From this, the deduction is that computer-aided systems add to the chances of project success in a meaningful way.

## 2.6 Challenges in the Adaptation and Use of Computer-Aided Systems

Even though the use of computer-aided systems is clearly beneficial, this has not led to its widespread use. As observed by O'Brien and Marakas (2010) any new way of doing things brings about some opposition from the people affected. Also indicated as the other factors hampering the adoption and use of information systems are the following: human resource challenges, funding, information technology challenges, integration to existing systems, management buy-in and end-user buy-in.

Even in those organisations where the adaptation and use of computer-aided systems has been successful, its acceptance and use by project management professionals is largely as a result of a number of factors (Caniëls and Bakens, 2012). These factors are listed below:

1. The quality of the information generated by the the system.
2. The ability of the system to provide them with an appropriate level of detail in relation to their specific needs.
3. The generated information is free of ambiguities and complexities and that is easy to understand, and share with others.
4. The system facilitates the continous monitoring of progress and project deliverables.

## 2.7 Computer-Aided Systems and the Ghanaian Construction Industry

Documentation of the use of computer-aided systems and therefore computer-aided project planning and control systems in the Ghanaian construction industry in literature is not available. Ghana, with an arguably young construction industry can and should learn

useful lessons from the various research and studies carried out in more industrialised construction environments. The various benefits that the implementation of computer-aided systems in project planning and control can deliver as attested to by available literature can be relevant to the Ghanaian construction industry also. This can however be only achieved by the closing of the project management knowledge and practice gaps found in the Ghanaian construction industry. The use of computer-aided project planning and control systems as a means of planning and controlling projects and ultimately enhancing project success is worthy of consideration in this regard.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter details the methodology that was used in carrying out the research in order to ensure the research question and address the objectives that were stated in Chapter One. This chapter also gives an account of the sampling techniques and procedures used. These include target population identification, sample selection and sample size. Also described in this chapter are the data collection instrument along with the procedures adopted to maintain the validity and dependability of the instrument are described.

## 3.2 Research Approach and Design

In order to achieve the purpose of this research, a quantitative approach was employed. The primary method of data collection was through the administration of questionnaires which were distributed and filled by respondents electronically. The reasoning for this approach is because quantitative methods focuses on the objective appraisal and numerical analysis of data assembled through the administration of questionnaires, surveys or polls. Quantitative research methods also targets the accumulation of numerical data and the generalization of said data across groups of people (Babbie, 2010).

## 3.3 Research Setting

This research was conducted in the city of Accra in Greater-Accra Region of Ghana. The research was conducted among a selected number of construction consulting professionals in the construction industry and the professionals working for D1 class of building

contractors - as set out by the Ministry of Water Resources, Works and Housing, MWRWH - operating in the city. This was done because in the opinion of the author, most of the large scale complex building projects that would require extensive project planning and control systems are carried out by these professionals and in this city.

### 3.4 Sampling

Purposive sampling was used in selecting the various professionals in the construction firms and industry who are to answer the questionnaire. The purpose was to engage personnel who are explicitly involved in the administration and supervision of projects in order to acquire information and responses central to the study. Based on an analysis of Krejcie and Morgan (1970) sixty-six (66) was arrived at as the sample size. The sample size was arrived at after study of the empirical table that they developed to aid in the determination of sample size from a given group. Out of the sixty-six (66), half of the sample were made up of professionals from the 2016 class of registered Architects as compiled by the Architects' Registration Council and the other half were from D1 construction companies currently operating in Accra. The reason for choosing Architects is that Architects are generally considered the heads of project teams. Also, Architects are the professionals who traditionally manage projects for clients are therefore expected to monitor the progress of construction activities on site.

Table 3.1: Determination of Sample Size from a Given Population

| *N* | *S* | *N* | *S* | *N* | *S* |
|---|---|---|---|---|---|
| 10 | 10 | 220 | 140 | 1200 | 291 |
| 15 | 14 | 230 | 144 | 1300 | 297 |
| 20 | 19 | 240 | 148 | 1400 | 302 |
| 25 | 24 | 250 | 152 | 1500 | 306 |
| 30 | 28 | 260 | 155 | 1600 | 310 |
| 35 | 32 | 270 | 159 | 1700 | 313 |
| 40 | 36 | 280 | 162 | 1800 | 317 |
| 45 | 40 | 290 | 165 | 1900 | 320 |
| 50 | 44 | 300 | 169 | 2000 | 322 |
| 55 | 48 | 320 | 175 | 2200 | 327 |
| 60 | 52 | 340 | 181 | 2400 | 331 |
| 65 | 56 | 360 | 186 | 2600 | 335 |
| 70 | 59 | 380 | 191 | 2800 | 338 |
| 75 | 63 | 400 | 196 | 3000 | 341 |
| 80 | 66 | 420 | 201 | 3500 | 346 |
| 85 | 70 | 440 | 205 | 4000 | 351 |
| 90 | 73 | 460 | 210 | 4500 | 354 |
| 95 | 76 | 480 | 214 | 5000 | 357 |
| 100 | 80 | 500 | 217 | 6000 | 361 |
| 110 | 86 | 550 | 226 | 7000 | 364 |
| 120 | 92 | 600 | 234 | 8000 | 367 |
| 130 | 97 | 650 | 242 | 9000 | 368 |
| 140 | 103 | 700 | 248 | 10000 | 370 |
| 150 | 108 | 750 | 254 | 15000 | 375 |
| 160 | 113 | 800 | 260 | 20000 | 377 |
| 170 | 118 | 850 | 265 | 30000 | 379 |
| 180 | 123 | 900 | 269 | 40000 | 380 |
| 190 | 127 | 950 | 274 | 50000 | 381 |
| 200 | 132 | 1000 | 278 | 75000 | 382 |
| 210 | 136 | 1100 | 285 | 1000000 | 384 |

Note.—*N* is population size.
*S* is sample size.

*Source*: Krejcie, R.V. and Morgan, D.W. (1970) Determining Sample Size for Research Activities, Educational and Psychological Measurement.

### 3.5 Data Collection

The cornerstone of every research is the data and so this makes data collection vital to every research. Marczyk et al. (2005) posits that if inappropriate measurement strategies are used during the data collection stages, even the best planned studies will be proved unusable. The source of the data for this research was the various construction professionals who responded to the questionnaire that was circulated, making it a primary one. No other form of data was collected or used in the analysis.

#### 3.5.1 Data Collection Instrument

A questionnaire was used as the main means of collecting data. This questionnaire was designed based on information gathered from the literature review and personal observations of the Ghanaian construction industry. This questionnaire was sub categorised into three different sections as follows:

- Section One deals with the solicitation of the professional demographics of the respondents, where it seeks to acquire information such as their primary role on projects, their level of experience in the construction industry and the number and financial value of projects they have been involved in, over the past five (5) years.
- Section Two seeks to determine the awareness of the respondents to the use of information systems and computer aided project planning and control tools in particular and the components that are usually used. It also seeks information on the various levels of knowledge the respondents had concerning the use of computer aided project planning and control tools. Furthermore, it focuses on the extent to which computer aided project planning and control tools are used on the

projects the respondents have been involved in and the challenges encountered in the use of these tools.

- Section Three deals with the challenges of implementing computer aided project planning and control systems and suggestions for successful integration of such systems as part of construction management in Ghana.

### 3.5.2 Procedure for Data Collection

The collection of data was carried out electronically. The distribution of the questionnaire and the filling of same was done through the internet by the use of the Google Forms portal. The use of this method was primarily as a result of the ease and convenience of distribution and collating of the information. An email was sent to the target survey population explaining the rationale for the research need for the completion of the questionnaire. The data was collected over a period of a week. Respondents were encouraged to contact the author for any clarification that they might have needed when filling the questionnaire. At the end of the week, a follow up email was sent to encourage them to complete the questionnaire with the survey period extended by another week.

## 3.6 Data Processing and Analysis

### 3.6.1 Collation of Data

The data for this research was collated electronically. This was done to make it easier to transfer the survey results to a spreadsheet processor for further analysis. Of the sixty-six (66) questionnaires sent out, a total of forty-one (41) responded making the response rate 62.12%. Baruch and Holtom (2008) found out that any response rate of 52.7% or above

is sufficient for any research that made use of data collected from individuals. The data collected from the respondents was found to be good for the research seeing as only the completed questionnaires could be submitted.

### 3.6.2 Management and Storage of Data

As stated earlier, data is the cornerstone of any research and so a concentrated effort was to ensure the safety and security of the data. This was to ensure that the integrity of the data was safeguarded at all times. It was also to ensure that the data was not lost. This was done primarily by keeping copies of the data on flash drives, external hard drives and in the cloud.

### 3.6.3 Analysis of Data

Descriptive Statistics was used to evaluate and present the results of the study seeing as the research is an exploratory one. This approach made it possible for the author to summarise the properties of responses received using values such as frequency, percentages and means. In order to better present the results of the analysis, graphical representations in the form of graphs, bar and pie charts.

## 3.7 Ethical Considerations

To ensure the integrity of this research, a number of actions were taken. Participation in the survey was voluntary without any form of coercion. In order to ensure that the responds were independent and unbiased, anonymity and confidentiality of the

respondents was guaranteed. This was done through proper data management techniques and the fact that no personal information was solicited.

### 3.8 Reliability and Validity

#### 3.8.1 Reliability

The uniform mode of administering the questionnaires and the effort made by the author to ensure that the instruction and contents of the questionnaire was understood by all professionals who responded.

#### 3.8.2 Validity

Validity of a part as defined by Bordens and Abbott (2011) is the extent to which it measures what you plan for it to measure. With this in mind, the data collection instrument was designed to contain questions that bordered on the research. The questions were tied to the information gathered from the review of literature on the subject and were crafted in a language that was simple and clear to ensure easy understanding. In order to ensure the external validity of this research, the choice of population sample is one that is representative of the Ghanaian construction industry.

### 3.9 Limitations and Delimitations

#### 3.9.1 Limitations

There are limitations to the generalisation of the research findings because this research was limited to project planning and control in the Ghanaian construction industry using a sample of construction professionals in Accra. This notwithstanding, the repetitive nature

of construction methods and the professionals sampled increases the chances of the result being adapted to the broader construction industry in Ghana.

Another factor that limits the result of this research is time. The duration of the survey is rather short at 2 weeks. Also, the timeline within which the research was carried out may be interpreted as just a snapshot of existing industry conditions. To address this, the research questions were based on established literature.

The final issue that can be said to have a limitation on the research is the mode of administration of the questionnaire. Seeing as the questionnaires were administered electronically through the internet, the opportunity of offering any clarifications to any respondents who may have needed it. This is offset by the fact respondents were encouraged to contact the author should they need any clarification.

### 3.9.2 Delimitations

This research was carried out based on the research interest of the author in the use of computer aided project planning and control systems. The study was restricted to construction industry professionals in Accra. This study only covers a limited area of construction management in Accra.

# CHAPTER FOUR

# RESEARCH FINDINGS

## 4.1 Introduction

The results of the survey as garnered from the questionnaire is presented in this chapter. The discussion of this results follows the presentation of the said results. This was done to examine the results and to ascertain the various implications thereof. The research question for which this survey was carried out was to determine the extent of use of computer aided project planning and control system.

## 4.2 Sample Characteristics

### 4.2.1 Respondents' Organisational Type

The various respondents to the questionnaire were distributed among three (3) groups of organisations: consultancy, contracting and design and build contracting. Of the forty-one (41) respondents, fourteen (14) of them representing 34 % belonged to the consultancy organisations, eighteen (18) of them representing 44% to contracting organisations and nine (9) of them representing 22% to design and build organisations – this included two (2) respondents who indicated that they worked for real estate construction firm. This is illustrated graphically below.

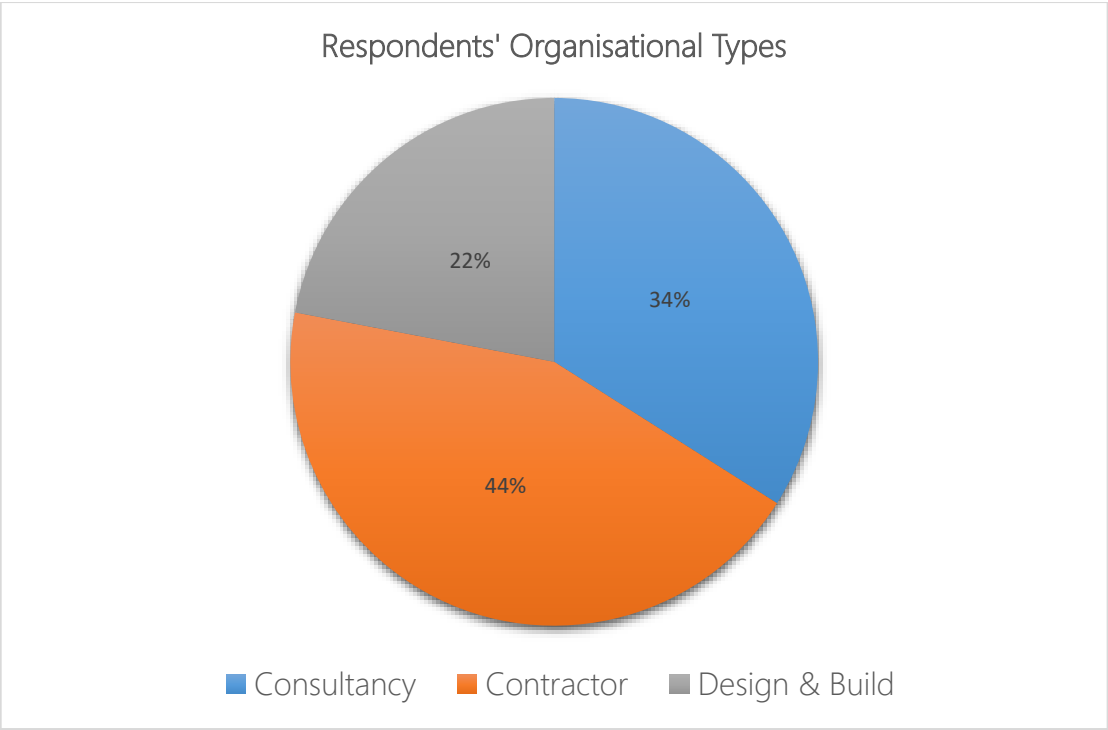


Figure 4.1: Respondents' Organisational Types

Source: Field Data, 2016

### 4.2.2 Respondents' Primary Role

Of the forty-one (41) respondents, eleven (11) representing 27% were in Project/ Construction Management roles. Ten percent (10%) defined their role as that of a Site Engineer whilst 7% said 'Planner' best described their current role. Forty-four percent (44%) described their role as that of a Consultant – Project architect - with the 12% left choosing the 'other' option with role definitions such as Quantity Surveyor and Site Manager.

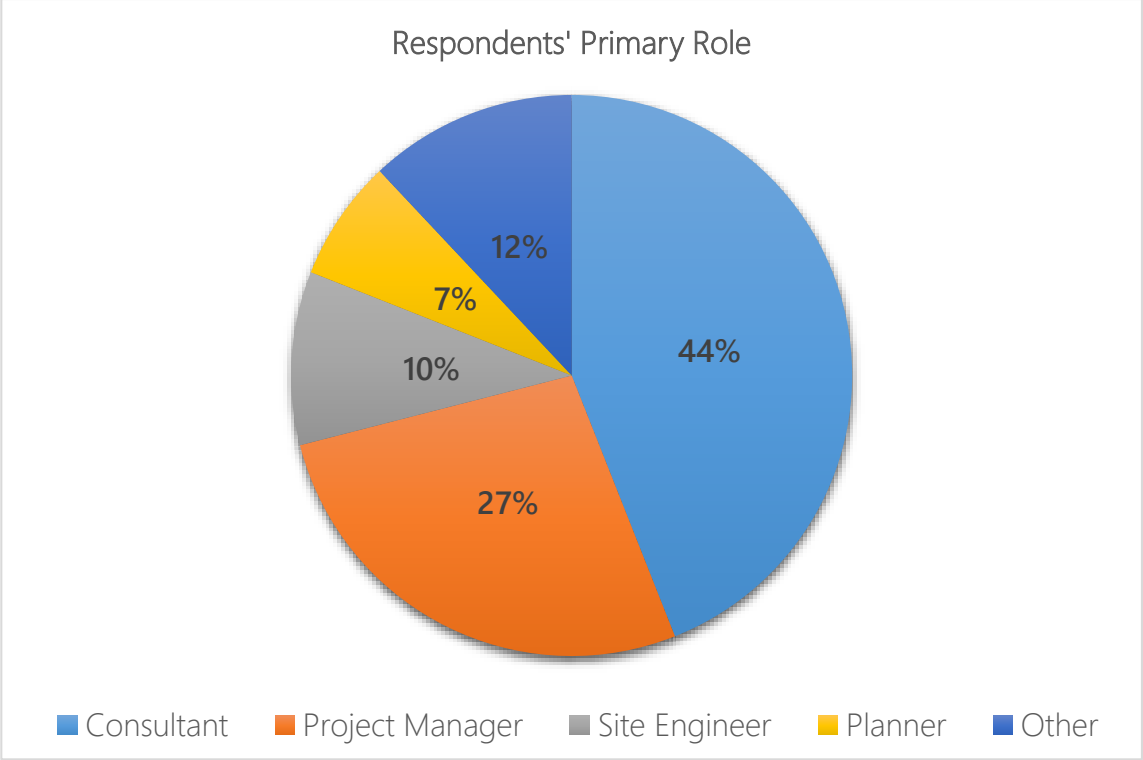


Figure 4.2: Respondents' Primary Role

Source: Field Data, 2016

### 4.2.3 Respondents' Experience

Of the respondents, five (5) of them making up 12% have more than fifteen (15) years of construction industry experience. An additional 12% have experience which they described as being more than ten (10) years but less than fifteen (15) years. Forty-four percent (44%) have experience which is more than five (5) years but less than ten (10) years. The rest of the respondents, the 32% left have less than five (5) years of industry experience.

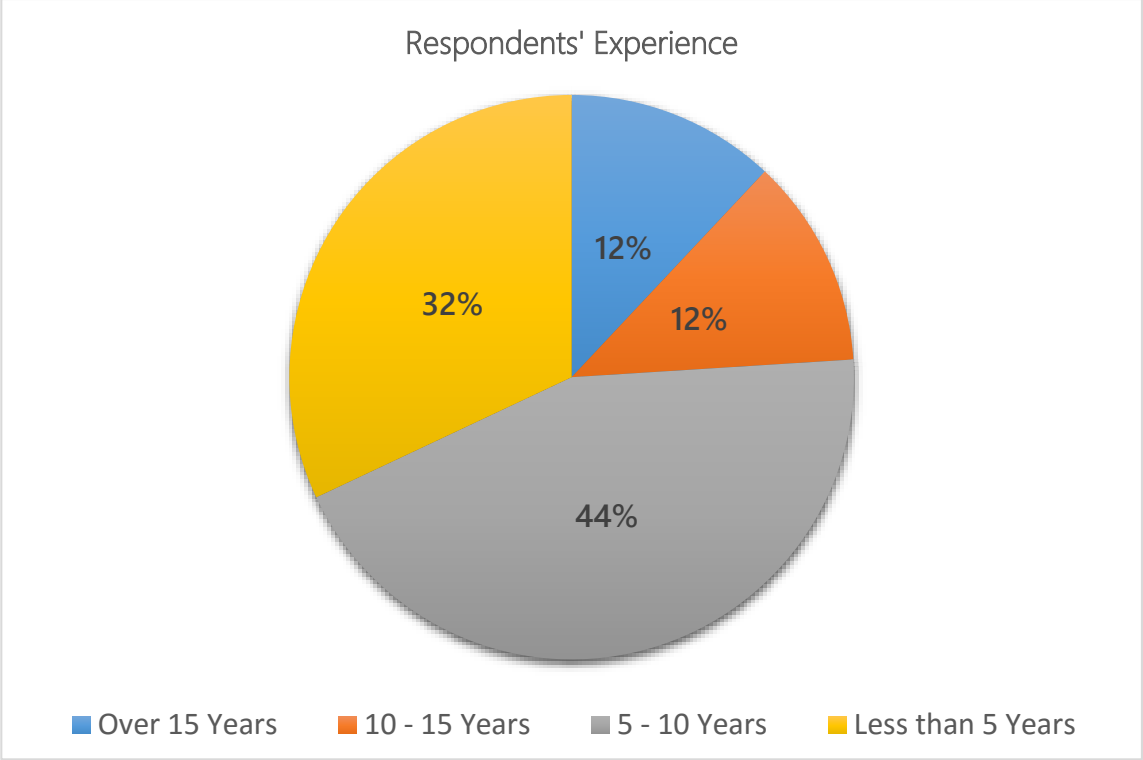


Figure 4.3: Respondents' Experience

Source: Field Data, 2016

### 4.2.4 Average Number and Size of Projects

Respondents were asked about the number of projects that they have been involved in over the last five (5) years. Twenty (22) respondents making up 54% have been involved in five (5) or more projects. Four (4) of them making up 10% have been involved in exactly four (4) projects; nine (9) making up 22% have been involved in exactly 3 projects; fourteen percent (14%) have been involved in only 2 projects over the last five (5) and none of them have been involved in only one (1) project.

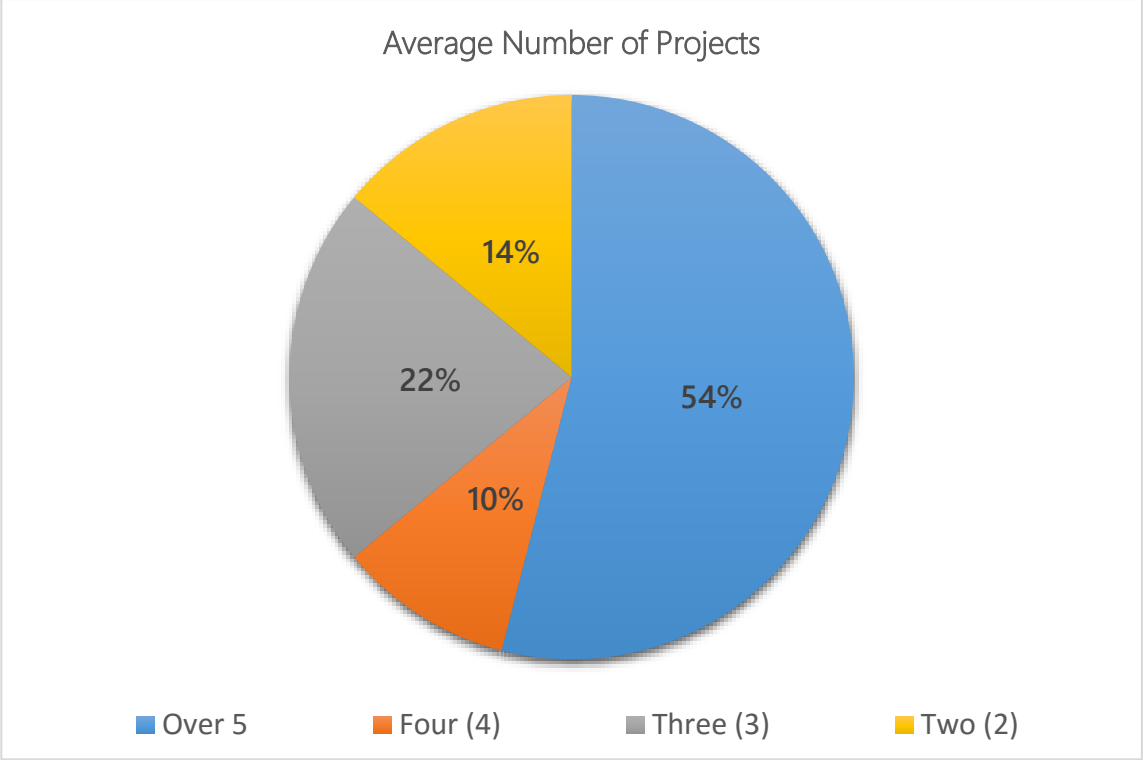


Figure 4.4: Average Number of Projects

Source: Field Data, 2016

The average monetary size of the projects that the respondents have been a part of over the last five (5) years was also ascertained. Six (6) of the respondents who make up 14% of respondents revealed that the average monetary value of their projects over the last five (5) years was $10,000,000.00 or more. Thirty-seven percent (37%) said the average monetary size was more than $5,000,000.00 but less than $10,000,000.00. The same number, 37% answered that for them, the average monetary size of their projects was more than $1,000,000.00 but less than $5,000,000.00. Five (5) making up the final 12 % of the respondents had an average project monetary size of less than $1,000,000.00. The inference from this is that the average monetary value across board is quite sizable and as

such it's likely to make use of computer aided project planning and control systems (CAPPCS).

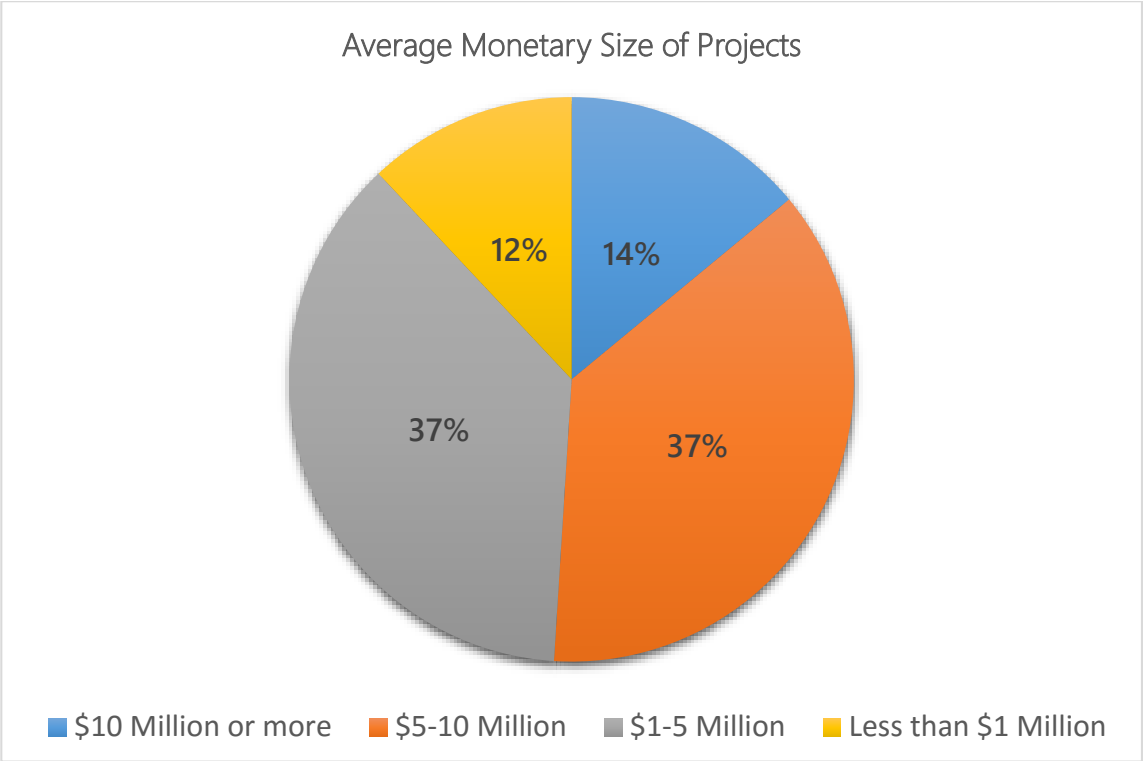


Figure 4.5: Average Monetary Size of Projects

Source: Field Data, 2016

### 4.3 Respondents Awareness of Computer Aided Project Planning and Control Systems (CAPPCS)

Respondents were asked a number of questions to help determine their awareness and extent of use of CAPPCS, software, in the planning and control of projects. All the respondents were aware of CAPPCS. Discussed below are the rest of the findings.

### 4.3.1 Planning and Controlling a Project

The first step in determining the awareness of respondents to the use of CAPPCS was to find out how they planned and controlled projects in the first place. To this end, respondents were asked to provide feedback on this. Seven (7) out of the forty-one (41) representing 17% of respondents said they did this exclusively manually through the use of planners, diaries etc. Sixteen (16) of them making up 39% did this exclusively electronically through the use of proprietary software. The final 44% used a combination of both procedures.

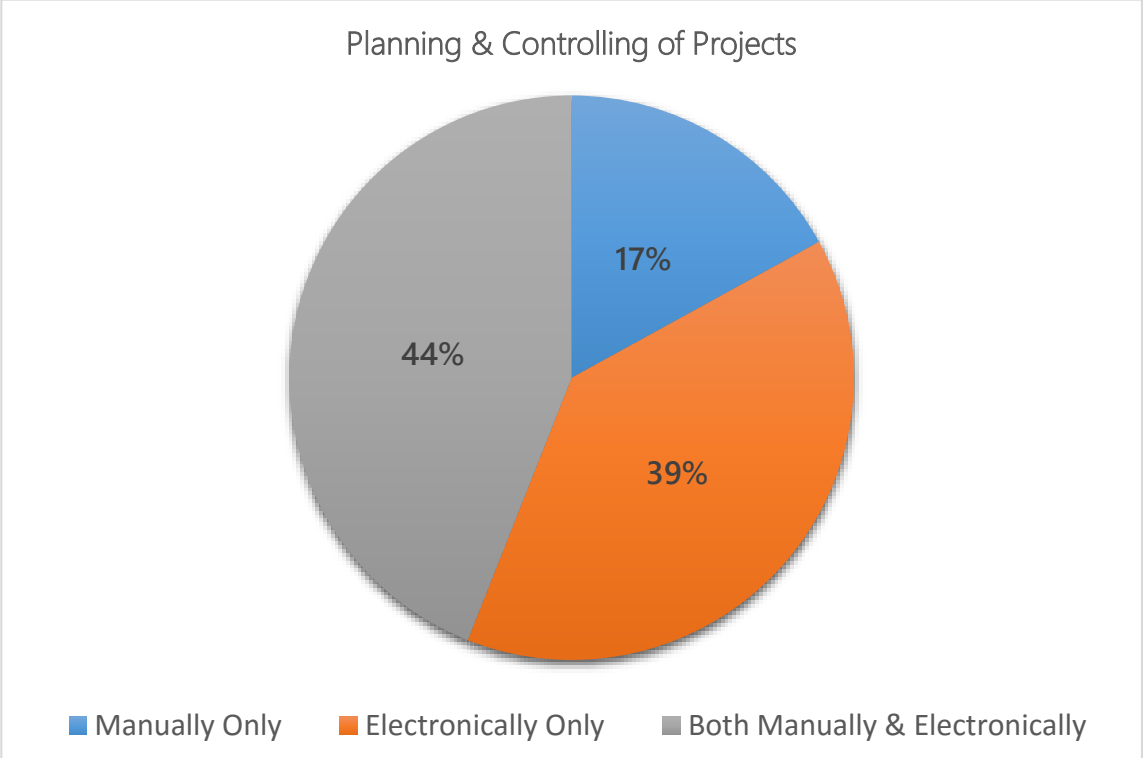


Figure 4.6: Primary Means of Planning & Controlling Projects

Source: Field Data, 2016

### 4.3.2 Frequency of Use of CAPPCS

To help determine the frequency of use of CAPPCS, respondents were to choose one of the options of ‘always’, ‘most of the time’, ‘sometimes’, ‘rarely’ and ‘not at all’ to a question regarding their frequency of personal use of CAPPCS on projects. Of the respondents, 19% answered to using CAPPCS always. Forty-two (42%) answered to using it most of the time, 27% used it sometimes with 6% using it rarely and the remaining 6% not using it at all.

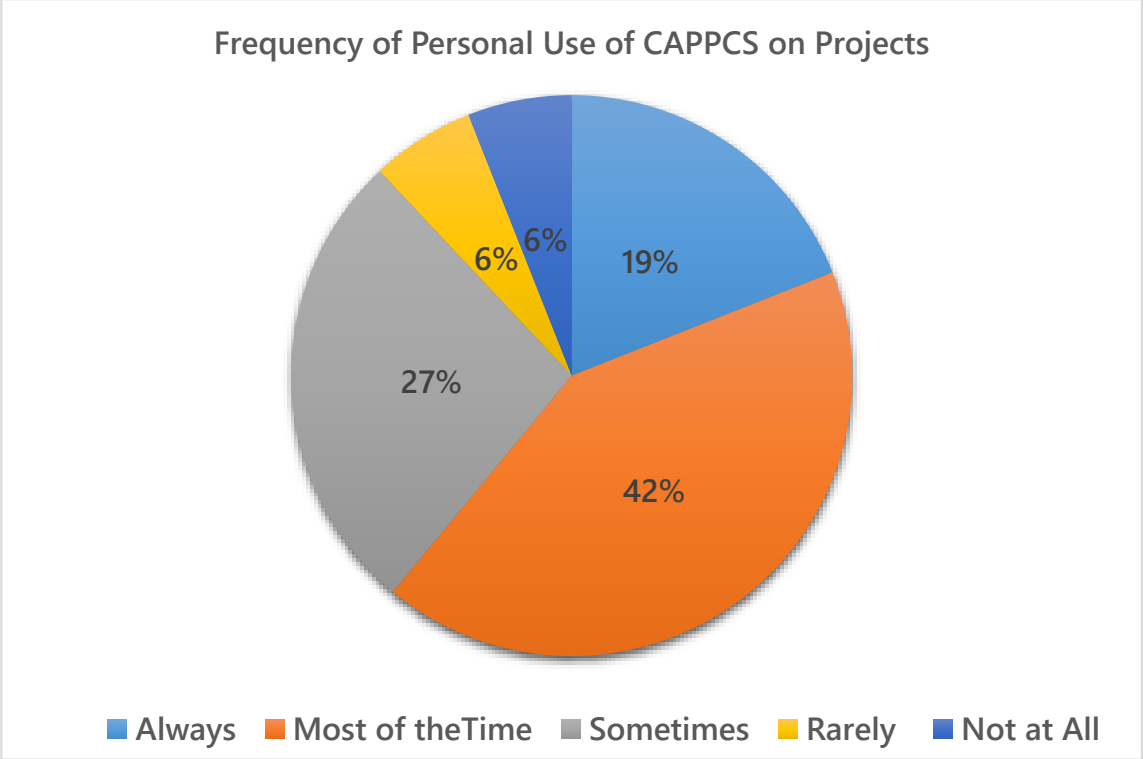


Figure 4.7: Frequency of Personal Use of CAPPCS on Projects

Source: Field Data, 2016

The deduction from this is that the respondents generally make use of software in the planning and control of projects. In addition, respondents provided information on the various scenarios when CAPPCS were used on projects that the firms that they worked

for undertook. Twenty (20) representing 49% of respondents indicated using CAPPCS on all projects; fifteen (15) making up 37% used CAPPCS on most projects with the 14% reporting using CAPPCS on projects only when required by the client. None of the respondents answered to not using it at all.

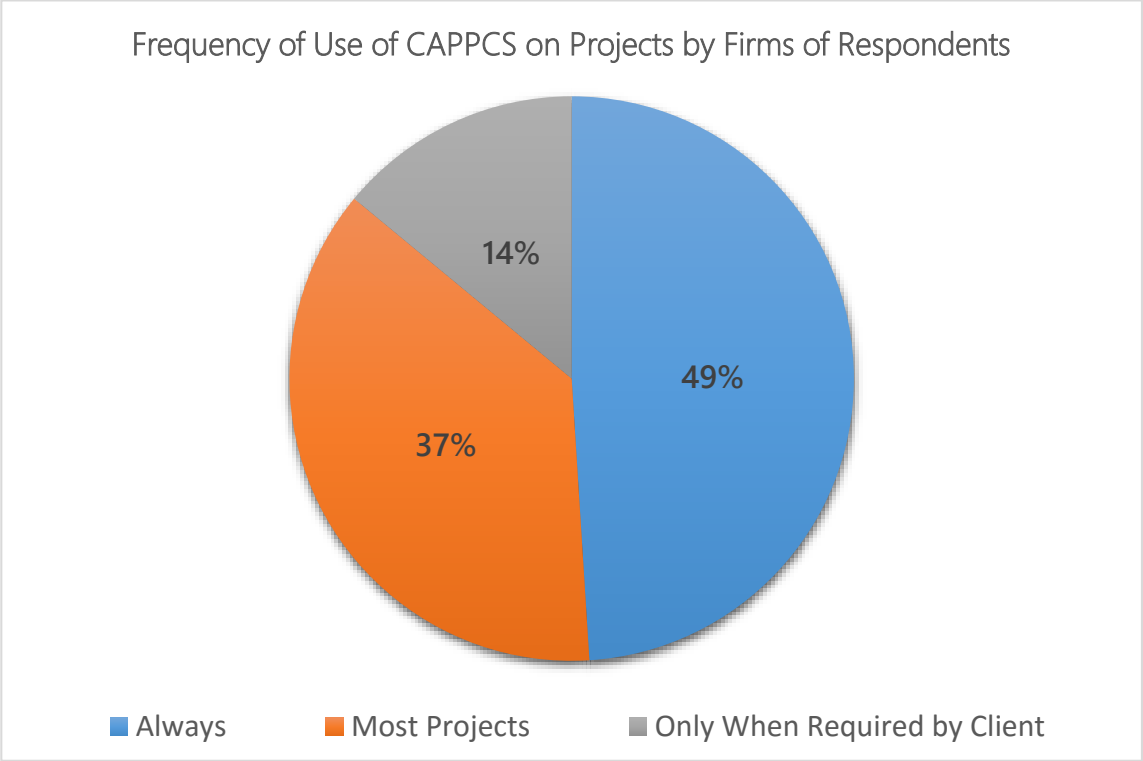


Figure 4.8: Frequency of Use of CAPPCS on Projects by Firms of Respondents

Source: Field Data, 2016

### 4.3.3 CAPPCS Administration Competency

When planning and controlling projects being carried out by the firms that they worked for, 78% of respondents indicated that in-house personnel carried out this. Ten percent (10%) indicated that outside consultants were engaged to run and administer the computer aided project planning and control system. The rest, 12%, indicated that they used a combination of both in-house and outside consultants.

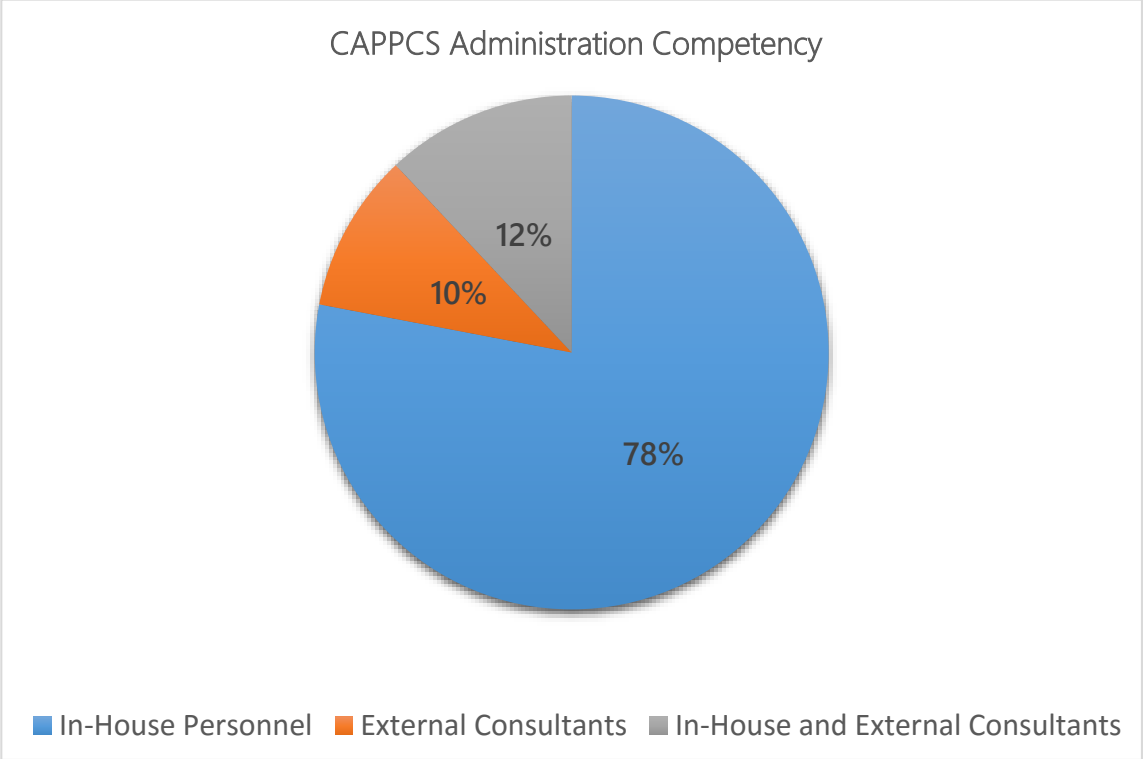


Figure 4.9: CAPPCS Administration Competency

Source: Field Data, 2016

Of the number that indicated that outside personnel were used, a number of reasons were indicated as being the cause with half indicating that outside personnel were engaged mostly because of the scale and complexity of projects. Other reasons were also cited as well. This is elaborated further in the graph below. The percentages show the number of respondents who considered that option a factor in deciding to use outside personnel to man the CAPPCS.

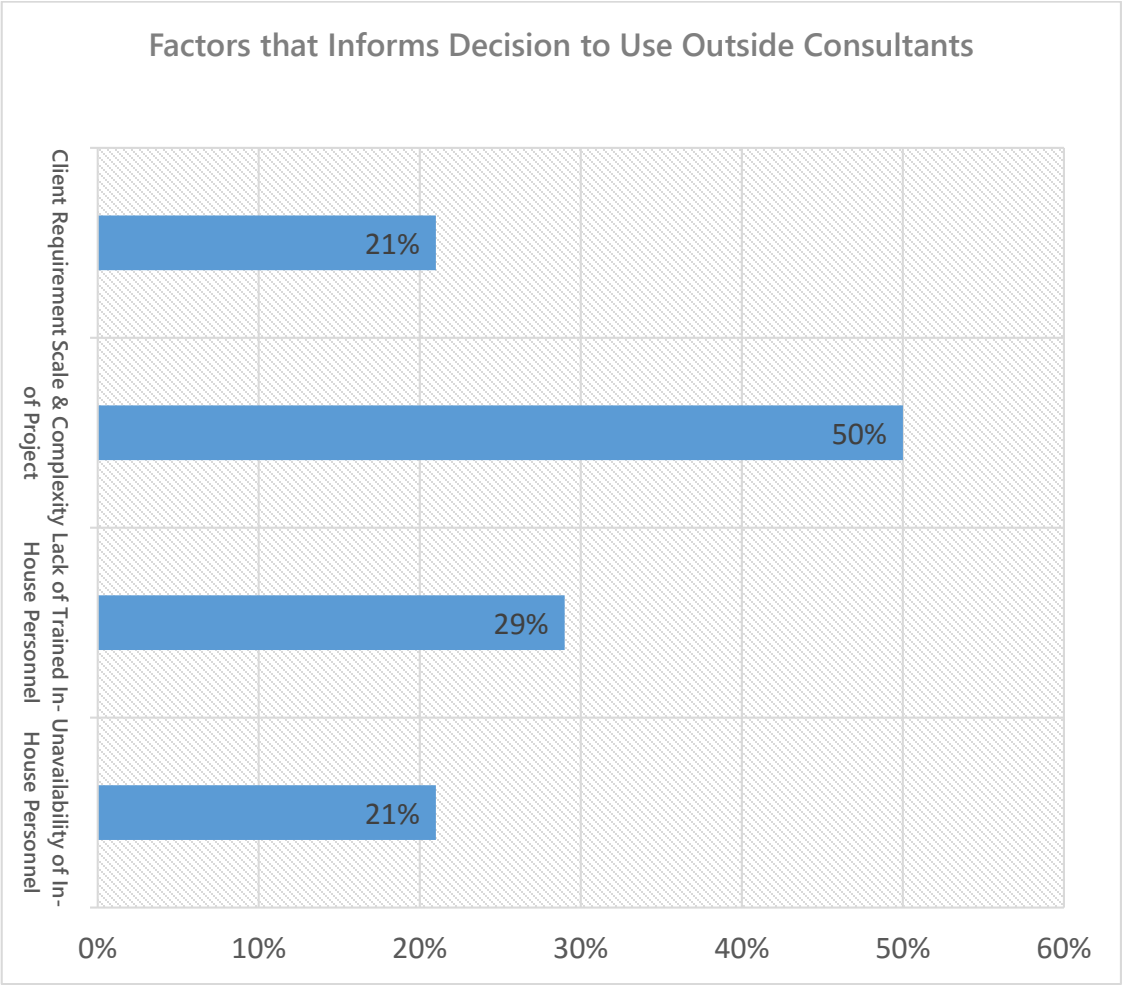


Figure 4.10: Factors that Inform Decision to Use Outside Consultants

Source: Field Data, 2016

## 4.4 Usage of Computer Aided Project Planning and Control Systems (CAPPCS)

### 4.4.1 Forms of CAPPCS Used

Respondents provided information on the form of CAPPCS, software, used in planning and controlling projects. Stand-alone proprietary project planning and control systems on their own were used by 54% of respondents, spreadsheets alone were used by12% of the respondents whilst web based systems were not used at all. Thirty-four percent (34%) -

over a third - of respondents indicated using a combination of stand-alone proprietary project planning and control software and spreadsheets.

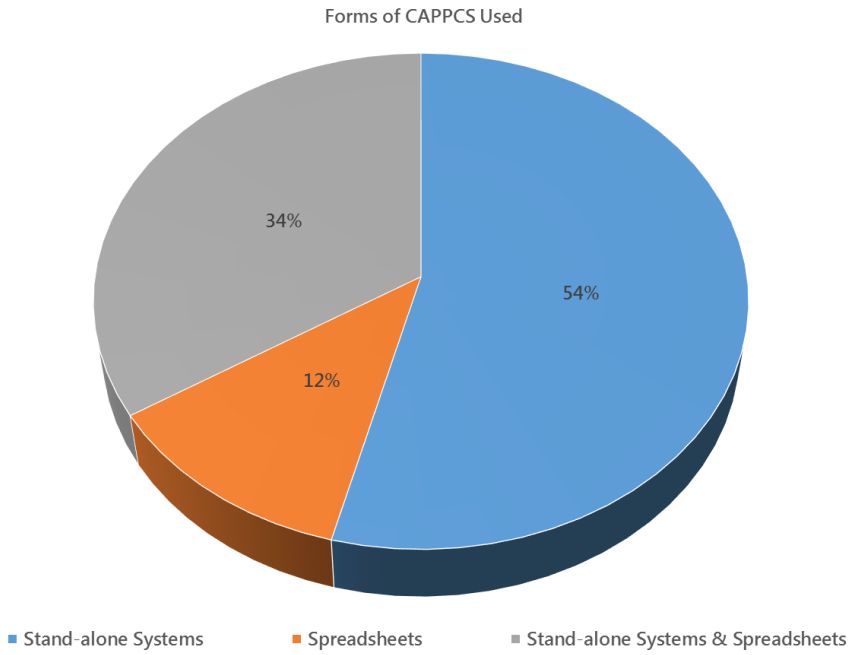


Figure 4.11: Forms of CAPPCS Used

Source: Field Data, 2016

#### *4.4.1.1 Stand-alone CAPPCS – Software - Used*

Further to the above, respondents were asked to provide information on the type of stand-alone CAPPCS used. The reasoning for this was to determine the various software that were being used for project planning and control in the Ghanaian construction industry. Responses indicated that the professionals surveyed used MS Project 95% of the time, Primavera was used 12% of the time and other software encompassing Candy Construction Software was used 10% of the time. However a detailed analysis of the survey response revealed that thirty-four (34) of the respondents used MS Project exclusively with two (2) each using a combination of MS Project and Primavera, MS

Project and Candy Construction and MS Project, Primavera and Candy Construction respectively. Only one (1) indicated using Primavera exclusively.

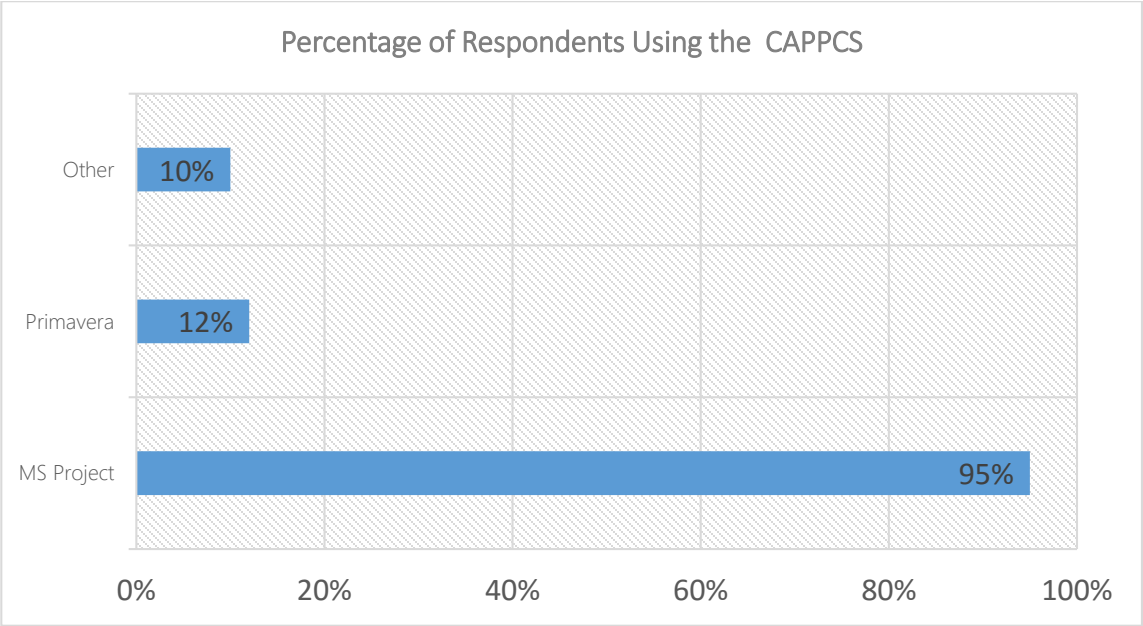


Figure 4.12: Various Software Used for Project Planning and Control in the Ghanaian Construction Industry

Source: Field Data, 2016

#### *4.4.1.2 Determination Factors for Choice of Stand-alone CAPPCS*

Respondents provided information on the factors that shaped their choice of stand-alone project planning and control system. Of the various factors, the 'ease of use' was the biggest factor in determining the choice of the CAPPCS used. This was followed by 'prior training of in-house staff'. The other factors after these were 'capability of the software'; 'price'; 'compatibility with existing software' and 'duration of learning curve'.

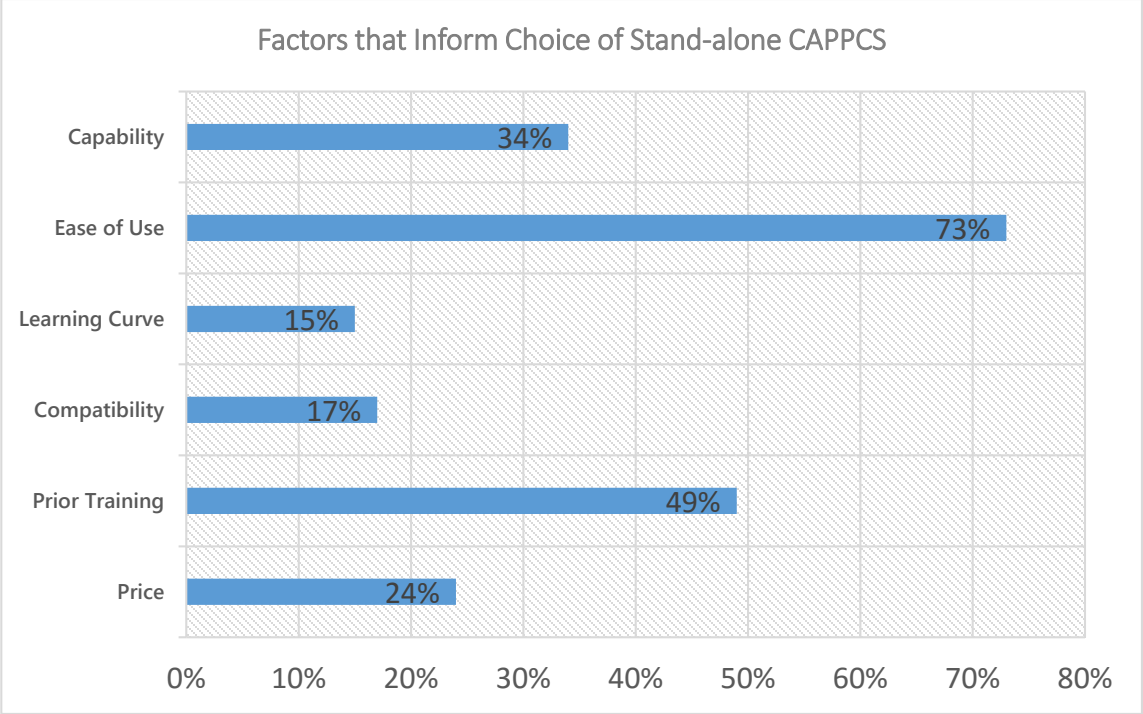


Figure 4.13: Factors that Inform Choice of Stand-alone CAPPCS

Source: Field Data, 2016

### 4.4.2 Frequency of Use of CAPPCS on a Project

Respondents were asked to indicate the frequency with which CAPPCS was used on any given project. Twenty-two percent (22%) of respondents indicated CAPPCS was used 'as and when required by the client'. Seventeen percent (17%) each indicated using it 'monthly' and 'weekly' respectively. Twelve percent (12%) indicated using it only at 'project milestones'. An equal number, 12%, expressed using as and when required by the client, at project milestones and monthly. Eight percent (8%) reported using it as and when required by the client, at project milestones and weekly. The full breakdown is given below:

Table 4.1: Frequency of Use of CAPPCS on a Project

| When CAPPCS is Accessed/ Used | Respondents | |
|---|---|---|
| | No. | Percentage |
| As and when required by the client | 9 | 22% |
| Monthly | 7 | 17% |
| Weekly | 7 | 17% |
| As and when required by the client, Project Milestones, Monthly | 5 | 12% |
| Project Milestones | 5 | 12% |
| As and when required by the client, Project Milestones, Weekly | 4 | 8% |
| Always | 1 | 3% |
| As and when required by the client, Monthly | 1 | 3% |
| As and when required by the client, Project Milestones | 1 | 3% |
| As and when required by the client, Weekly | 1 | 3% |
| Total | 41 | 100% |

*Source*: Field Data, 2016 – Extract from Analyses Using MS Excel

### 4.4.3 Components of CAPPCS Used

Of the various components available on a CAPPCS, respondents indicated – unanimously – that 'project (work) schedule' function was the most used. This was followed by the 'resource scheduling' option which was used by 49% of the respondents. Cost scheduling and control component was used by 37% of the respondents. Twenty-nine percent (29%) of respondents used 'procurement scheduling' components. Seventeen percent (17%) used the system to register quality control issues. Fifteen percent (15%) used it as a register for document control whilst 10% used it to register risks issues.

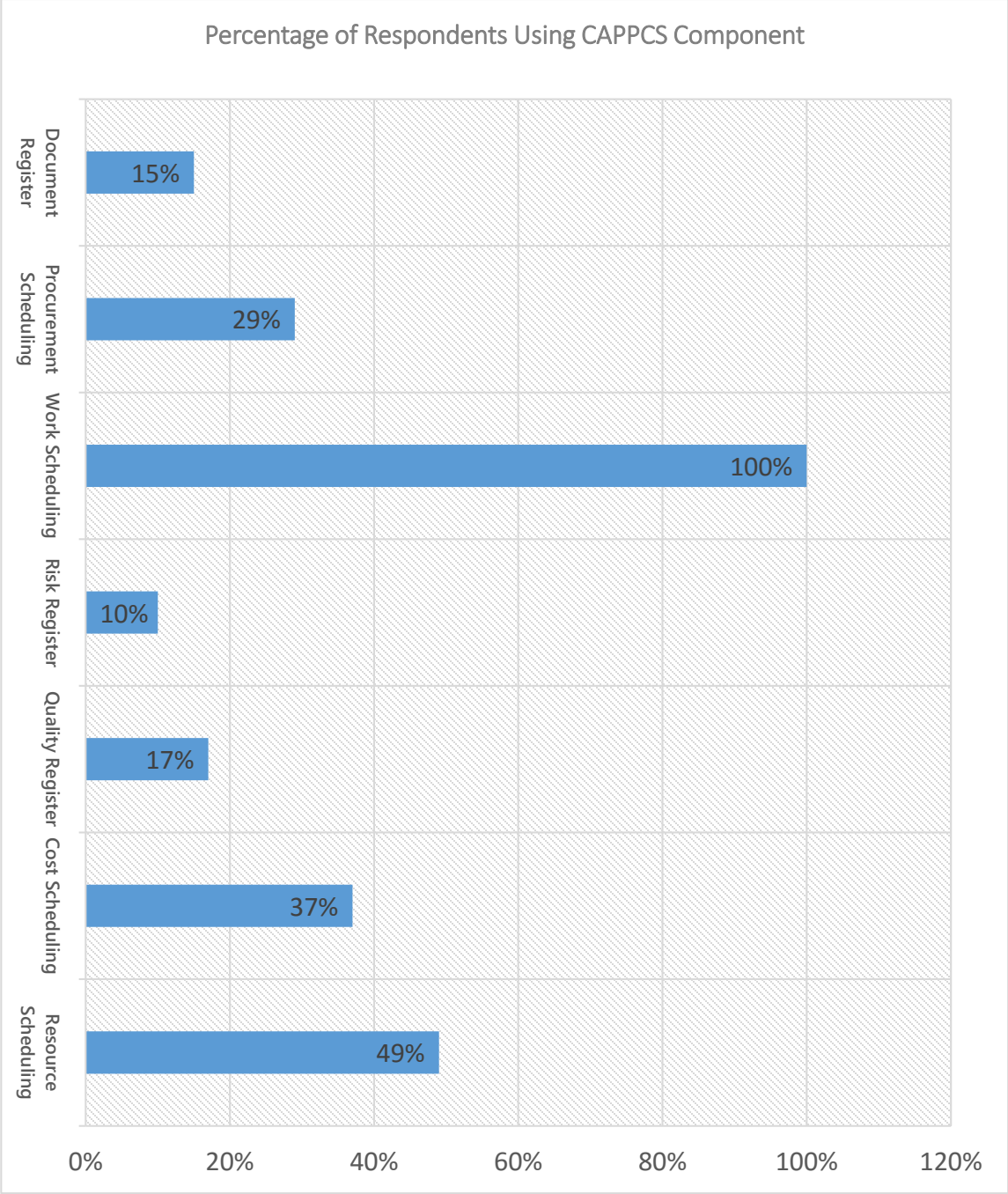


Figure 4.14: Components of CAPPCS, Software, Usually Used

Source: Field Data, 2016

### 4.4.4 Capabilities of CAPPCS

When providing information on the capabilities that respondents would like to have on a CAPPCS, 78% of respondents indicated that for them, 'risk management' – the ability to attach information on risks to various tasks to mitigate the ambiguities and avoid interruption to flow of the project – as one of them. Sixty-six percent (66%) answered that 'quality control' – the ability to affix test documents to specific tasks – was a capability that they would want a system to have. The other capabilities that respondents would want a CAPPCS system to have that were not addressed by their current system were resource allocation, monitoring and control, scope definition, specific project deliverables, project timelines and assignments/ responsibilities. The inference from this is that some of the respondents are not aware that their current systems have capabilities to achieve these requirements already.

When asked to determine the overall system capabilities that respondents consider to be of utmost importance for a CAPPCS, 'decision support systems' – the capability to translate data into coherent information for decision making at executive management level – was selected by 89% of the respondents. This was followed by the 'control' – monitoring and analysing performance including scope, budget, schedule, quality and risks – at 78%. More than half of the respondents at 59% also considered 'communication' – the means to exchange information among the various stakeholders – as important.

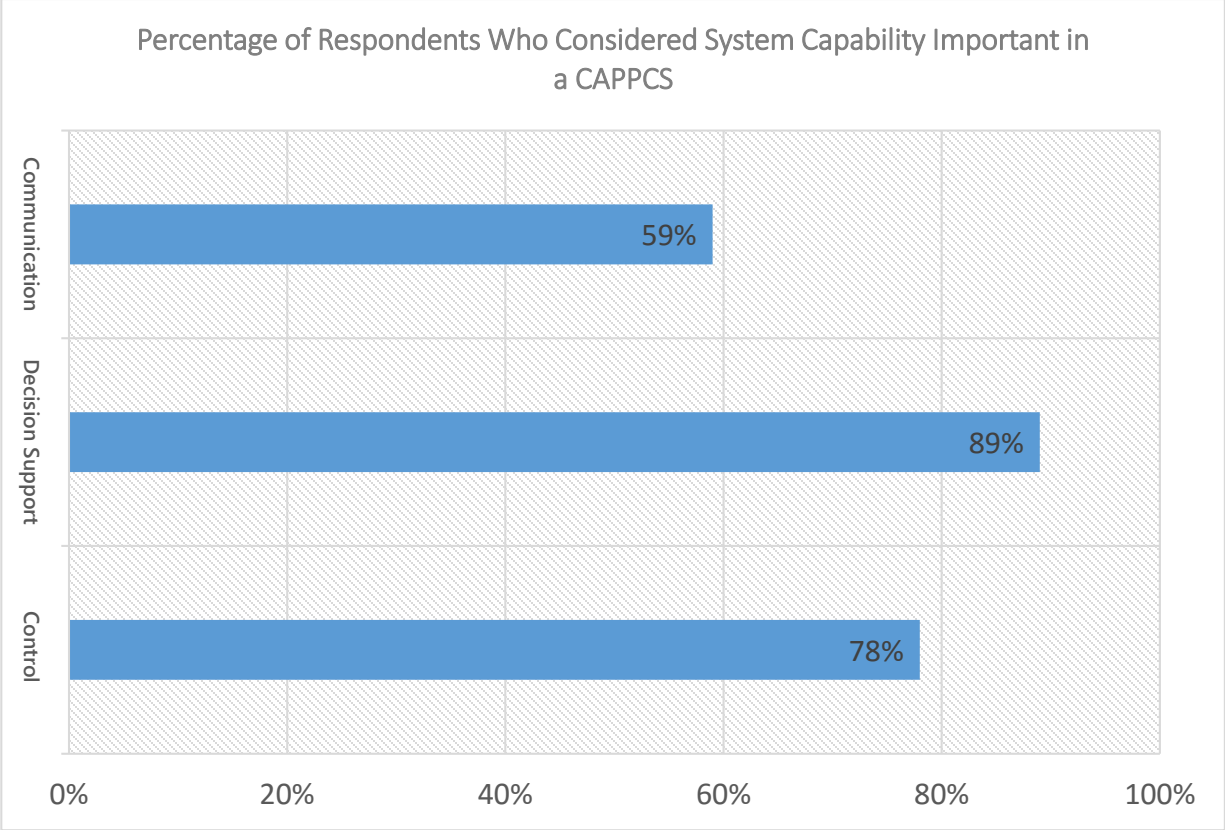


Figure 4.15: Importance of System Capabilities to Respondents

Source: Field Data, 2016

### 4.5 Barriers to Implementation

On the barriers to the adoption and use of CAPPCS on projects, 'lack of trained personnel' was selected by 71% of respondents. This was followed by 'cost of procuring and running the system' which was chosen by 66% of respondents. Next seen as a barrier to implementation is the 'lack of available ICT infrastructure' at 29%. After that, 17% indicated 'lack of managerial support as a barrier to the adoption and use of CAPPCS with only 12% of respondents indicating 'fear of role changes as a barrier to implementation.

### 4.6 General Discussion on the Awareness and Use of CAPPCS in the Ghanaian Construction Industry

All the respondents were aware of computer-aided project planning and control systems. The respondents also indicated having used these systems in some way on the project that they have worked on albeit with some limitations.

Respondents indicated that they expected a CAPPCS to deal with various project management functions. These functions include time, cost, project scope and quality and risk management. The nature of the response indicated a preference for integrated systems that are capable of enhancing project management by providing 'decision support systems' – the capability to translate data into coherent information for decision making at executive level. This is similar to the findings of a study carried out by Eweje et al. (2012) which indicated that a thorough understanding of the information at the disposal of project managers puts them in a better stead to make decisions that ultimately advances the administration of whichever projects they are managing.

This research also found out that the major issue that was a barrier to the widespread adoption and thorough use of software in project planning and control in the Ghanaian construction industry was the lack of trained personnel to man these systems. This also goes to support the research carried out by Ofori (2013) that asserts that until recently, Project Management was not taught in schools. In a section that respondents were encouraged to provide feedback on how to improve project planning and control, most admitted a widespread and thorough use of CAPPCS was essential along with the training

and tooling of industry professionals on how to use these systems as the use of these systems contributed to project success in a myriad of ways.

# CHAPTER FIVE

# CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

The construction sector of any country cannot be disregarded seeing as the construction industry plays such an essential role in a country's economy as established earlier. This is as result of the various socio-economic benefits that are accrued as either a direct or indirect result of construction activities. The purpose of this research was to ascertain the level of awareness of Ghanaian construction industry professionals of the use of computer aided project planning and control systems. This research also solicited information on the different aspects of the various project planning and control systems that are used and recommendations for their successful integration and application as an essential Construction Management tool.

This study uncovered the various tiers of awareness and the magnitude of the use of project planning and control computing systems by Ghanaian construction industry professionals. To reach this goal, questionnaires were administered to sixty-six (66) professionals – forty-one (41) of who responded - who were sampled from contracting and consulting organizations working in Accra. In this chapter, the principal discoveries from this research are presented along with conclusions and recommendations that were drawn from the findings.

## 5.2 Summary of Research Findings

As evidenced by the contents of the preceding chapter, this study has fulfilled its objectives which were to:

The major findings were:

1. One hundred percent (100%) of the professionals canvassed were aware of computer aided project planning and control systems.
2. The general usage of project planning and control computing systems by professionals themselves was found to be slightly above average with 61% of respondents choosing the 'most of the time' or 'always' option on that assessment. On projects being carried by their firms, the usage of CAPPCS increased with 86% indicating using it on 'all projects' or 'most projects'. The use of the systems was however limited to just a few of the functions available – mostly the work scheduling function, as compared to the whole systems.
3. From the results, respondents agreed that a comprehensive system that addressed all the planning and control needs of a project along with tools for effective decision making will be welcomed. Also, a majority of the respondents were of the opinion that the sensitization and training of professionals in the use of these systems was crucial if they are to be fully considered and used as essential construction management tools.

### 5.3 Conclusion

The conclusion drawn from this study is that professionals are aware of the use of project planning and control computing systems and that the use of such systems is above average. The use of the system was nonetheless found to be uncomprehensive as only a few of the available functionalities of the systems were used as opposed to making use of the full range of available functions. Also drawn from this study is the fact the full use and

integration of these systems was limited by the lack of professionals with essential training on how to fully utilize the various systems and the cost involved in procuring and running these systems.

Progressively, construction is becoming bigger in scale and complex in nature. It is therefore essential to equip industry professionals with the right knowledge and tools to better manage projects and contribute to the likelihood of projects being successful. With this, the case is made for the proper tooling and training of professionals on the use of project planning and control computing systems.

### 5.4 Recommendations

The following are the recommendations made as a result of the findings of this research:

1. Sensitization and training of industry professionals on computer aided project planning and control systems should be increased. Capacity building is essential. Consultant and contractor organisations should set up working modules to be followed on projects and to increase and encourage the use of these systems. Professionals should make an effort to use the full functions of existing systems as most of the tools required for the proper planning and control of projects are already available on these systems.
2. Clients need to be educated on the need and importance of the planning control measures on a project thereby setting the route for professionals to equip themselves with the tools and knowledge required to run these systems. Clients should make the use of project planning and control computing systems

mandatory, possibly, as part of contractual obligations. Client should also insist on the compliance and use of these systems.

3. The building blocks for effective project planning and control should be laid at project design stage and should be an integral part of the tendering and costing process. Prospective contractors should be made to demonstrate familiarity with project planning and control computing systems at the pre-qualification stage of the tendering process and should be monitored to follow through on using and running the systems throughout the execution of the project.

### 5.5 Further Research Opportunities

There is a knowledge gap in the form of lack of literature on the use of information systems in general and computer project planning and control systems in particular in the construction industry in Ghana. In the light of this, it is essential that further studies be carried out on the subject matter in order to improve the body of knowledge currently available which will in turn lead to a better appreciation of the need for the use of computer aided project planning and control tools. Recommended as opportunities for further studies are the following:

1. A comparative study of the extent of use of project planning and control computing systems on government funded and privately financed projects.
2. An extensive study of the benefits derived from the use of computer aided project planning and control systems as evidenced on a prototypical project.

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APPENDIX 1 - SURVEY QUESTIONNAIRE

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**DEPARTMENT OF BUILDING TECHNOLOGY**

***EXTENT OF USE OF COMPUTER AIDED PROJECT PLANNING AND CONTROL TOOLS IN THE GHANAIAN CONSTRUCTION INDUSTRY.***

This questionnaire seeks to solicit accurate information on the perception of the use of computer aided project planning and control tools in the Ghanaian Construction Industry. Please provide feedback to the following questions by selecting one of the options and remember that there are no wrong answers. Your chosen answer should be based on your own experience on construction projects carried out in Ghana. Please note that information provided will be treated as private and confidential. Thank you.

**SECTION 1: GENERAL INFORMATION**

1. What best describes the type of firm that you work for?

☐ Consultancy/ Professional Service Provider

☐ Contractor / Sub-contractor

☐ Design & Build Contractor

Other (Please Specify)

2. How many years of experience do you have in the construction industry?

☐ Below 5 years

☐ More than 5 years but less than 10 years

- [ ] More than 10 years but less than 15 years
- [ ] More than 15 years

3. What best describes your current role?

- [ ] Project/ Construction Manager
- [ ] Site Engineer
- [ ] Planner
- [ ] Consultant

Other (Please Specify)

4. How many projects have you worked on in the last 5 years?

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5 or more

5. What is the average monetary value of the projects that you have been a part of in the last 5 years?

- [ ] Less than $1,000,000.00
- [ ] More than $1,000,000.00 but less than $5,000,000.00
- [ ] More than $5,000,000.00 but less than $10,000,000.00

- [ ] More than $10,000,000.00

**SECTION 2: AWARENESS OF PROJECT MANAGEMENT INFORMATION SYSTEMS IN THE FORM OF PROJECT PLANNING AND CONTROL SOFTWARE.**

6. Are you aware of the existence of computer aided project planning and control tools?

- [ ] Yes
- [ ] No

7. When working on a project, how do you plan and control them? (Please choose only one answer)

- [ ] Manually through the use of diaries and planners etc.
- [ ] Electronically with a proprietary software
- [ ] A combination of both

8. How often in the last 5 years have you, personally, used a computer aided project planning and control tool when working on a project?

- [ ] Always
- [ ] Most of the time
- [ ] Sometimes
- [ ] Rarely
- [ ] Not at all

9. How often in the last 5 years has the firm you work for used a computer aided project planning and control tool on their projects?

- ☐ All projects
- ☐ Most projects
- ☐ Some projects
- ☐ Only when requested by client/ contractual obligation
- ☐ Not at all

10. When you the firm you work for uses a computer aided project planning and control tool on a project, who runs the system? (Please tick only one option)

- ☐ In-house personnel (Staff from the firm)
- ☐ Outside consultants (Professionals from outside of the firm)
- ☐ A combination of both

11. If outside consultants are used, what informs such a decision? (Please tick all options that apply)

- ☐ Client requirement (Contractual Obligation)
- ☐ Lack of trained in-house personnel
- ☐ Unavailability of trained in-house personnel (Not enough trained in-house staff)
- ☐ Scale and complexity of project
- ☐ Cost (Cheaper to outsource)

Other (Please Specify)

12. Which of the following computing systems of project planning and control are used on projects that you have worked on?

- ☐ Stand-alone proprietary project planning and control software
- ☐ Web based software
- ☐ Use of spreadsheets like MS. Excel

13. If a stand-alone project planning and control software is used, which one is it?

- ☐ MS Project
- ☐ Primavera

Other (Please Specify)

14. What factors inform the choice of project planning and control software? (Please tick all options that apply)

- ☐ Price
- ☐ Prior training of current in-house staff
- ☐ Compatibility with other existing software
- ☐ Ease of use
- ☐ Duration of learning curve (time it takes to learn to use the software)
- ☐ Capability of software (graphic options, ability to handle large data etc.)

15. How often is the project planning and control software used on any given project?

- ☐ As and when required by the client

- [ ] Project Milestones
- [ ] Monthly
- [ ] Weekly

Other (Please Specify)

16. Which of the following aspects of the project planning and control software do you normally use on a project? (Please tick all options that apply)

- [ ] Project (Work) Scheduling
- [ ] Resource Scheduling/ Loading
- [ ] Cost Scheduling and Control
- [ ] Procurement Scheduling
- [ ] Documents register/ control
- [ ] Risk register
- [ ] Quality control register

**SECTION 3: BARRIERS TO IMPLEMENTATION & RECOMMENDATIONS**

17. What, in your opinion, would you say are the barriers to the use of project planning and control software on projects? (Please tick all options that apply)

- ☐ Lack of management support
- ☐ Cost of procuring and running the software
- ☐ Lack of available information technology infrastructure/ systems
- ☐ Lack of trained personnel
- ☐ Fear of role changes in the firm

Other (Please Specify)

☐

18. What needs do you currently have that your existing project planning and control system cannot resolve? (Please tick all options that apply)

- ☐ Defining Scope (i.e. the goal of the project and includes all the critical tasks required to complete it)
- ☐ Project Timelines
- ☐ Resource allocations (teams & individual assignments to tasks along with materials)
- ☐ Specific Project Deliverables
- ☐ Assignments/Responsibilities
- ☐ Risk management: Ability to incorporate risk information on various tasks to deal with uncertainty and avoid disruptions to the project flow.
- ☐ Quality control: Ability to attach test documents to specific tasks

☐ Monitoring & Project Performance

Other (Please Specify)

19. In your opinion, what capabilities will you consider as being of the utmost importance for a project planning and control software? (Please tick all options that apply)

☐ Communication (mechanism to exchange information among stakeholders)

☐ Control (monitoring and analyzing performance – scope, schedule, budget, risks, and quality)

☐ Decision support systems (capability to translate data into information that can be tailored to executive management for decision-making)

Other (Please Specify)

20. Based on your industry experience, please outline ways that project planning and control can be improved in the Ghanaian Construction Industry.

**Thank you for taking the time to respond to this questionnaire**