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EFFECTS OF SCHEDULING SOFTWARE USAGE ON PROJECT SCHEDULE MANAGEMENT PROCESSES: A STUDY OF SOME SELECTED CONSTRUCTION PROJECTS IN ACCRA

By

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DECLARATION

I hereby declare that this submission is my own work towards the MSc Project Management degree. 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 acknowledgment has been made in the thesis.

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ABSTRACT

Schedule management, as prescribed by the Project Management Institute, involves going through the processes required to accomplish timely completion of the project. This includes processes such as “plan schedule management”, “define activities”, “sequence activities”, “estimate activity durations”, “develop schedule” and “control schedule”. Of the twenty-four (24) planning processes expected to be performed during the project life cycle, 21% relate to the schedule management knowledge area. Given the iterative nature of planning processes, generating and managing a schedule could be very time consuming and complicated for the project manager. This study aimed at reviewing the extent of scheduling software usage on some selected construction projects within the Accra metropolis. It sought to determine the level of scheduling software deployment on the selected projects, determine the level of project management efficiency, and establish a correlation between the scheduling software deployment and project management efficiency and to lastly determine the extent of impact of scheduling software deployment on project management efficiency. The study began by reviewing available literature on the topic. Questionnaires were developed to solicit data from project management professionals and/or persons performing project management functions within the Accra metropolitan area which were analysed afterwards. It was found out that all the thirty (30) respondents had some scheduling software installed for their use. Only one (1) had a licenced software installed by his current organisation. The rest had working knowledge of scheduling software, albeit not beyond “moderately proficient” on a Likert scale of 1-4 interpreted as not proficient, below proficient, moderately proficient and proficient. There is therefore the need for adequate preparation of project managers and people who perform project management roles on projects in the area of scheduling software usage. It is recommended that organizations should engage the services of personnel with the requisite schedule management skills. They should be willing to put in more efforts to train their employees who are put on roles that require them to manage project schedules. The study limited itself to construction projects. It did not also consider the appropriateness of existing scheduling software to specific construction-related uses. Further studies in that area is recommended.

Keywords: Project Management, Scheduling Software, Project Management Efficiency, Schedule Management

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I dedicate this to my Aunty Esther Kwame Asana who took a particular interest in my formative years and whose sacrifice saw me through my secondary education up to my undergraduate level. May God bless you!

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Fundamentally, project management in the context of construction aims at effectively planning for, coordinating and controlling project objectives mindful the needs of various stakeholders (Harris and McCaffer, 2013). A number of processes work together in this phenomenon including project scope definition, estimating costs, project team responsibility assignment, employing the use of planning and other methods of control and diverse mechanisms. This calls for (adequate) knowledge of project management as a discipline in order to successfully come up with project plans and schedules, which essentially facilitate project delivery to satisfy the parameters of time or schedule, cost and quality (Heagney, 2011; Babu and Suresh, 1996; Whitty and Maylor, 2009). In the absence of the relevant know-how, the application or misapplication of project management concepts are likely to result in project plans that tend to be. The plans may turn out to have been generated poorly and therefore, performance of projects will most likely fall below expectation (Ahern *et al*., 2014). For emphasis, Ahern *et al*., (2014) attribute a major reason for poor project planning to inadequate knowledge about the applying theories appropriately in practice. Kerzner (2009) takes a conceptual stance and identifies that planning and scheduling and by extension, relevant activities that are required to achieve them, must be clearly defined to guarantee their success when applying them in practice.

As the world gets more sophisticated with the advent of information technology, companies are becoming more reliant on the successful deployment of information systems and management of projects (Juan *et al*., 2010). Citing the Standish Group

Chaos Report (2009), Zmud (1980) and Wallace *et al*., (2004) posit that about 44% of software projects were unable to be delivered on schedule within budget. That beckons the need for more effective ways of dealing with the all-important objective of timely completion of projects. The application and/or deployment of software in the field of project management has received significant attention from both academics and practitioners (Zmud, 1980; Wallace *et al*., 2004). Software has a substantial role to play in almost all fields apart from project management (Nair *et al*., 2011). The significant role played by project managers in effective project management cannot be overlooked. The project manager is fundamentally answerable for decisions regarding the need for resources in terms of budget, time, technology deployed, and requisite personnel assigned etc. for the implementation of desired application as elicited from prospective stakeholders (Nair *et al*., 2011). Nair *et al* (2011) further suggest that the success of project depends mostly on the project manager's capability to estimate certain parameters like the number of defects and its presence at the various phases of the project life cycle using scheduling software.

Hendrickson (1989) posits that construction companies operating with open-minded business models employ formal processes whenever the complication of activities is enormous and the management of a variety of diverse specialties and trades are requisite. Besides assigning specific dates to tasks, the intent of scheduling is to facilitate the optimum matching of resources; equipment/machines, constituent materials and labour with corresponding project activities over a period of time (Conlin and Retik, 1997). Proper scheduling has the tendency to reduce or significantly eradicate certain holdups and expedite the preparation for and execution of activities that fall within the critical path, thereby ensuring the completion of the

project within the desired timelines. These activities, if executed manually, can take considerable time and exhaust labour hours. But for the computerisation or automation of planning and/or scheduling activities, efficient project planning and scheduling would not be feasible, considering how enormous project planning could be. Project schedule management includes all of the processes required to ensure the timely completion of the project and this involves the determining the delivery dates and milestones whilst taking all of the known constraints into account (PMI 2017).

According to Heagney (2011), the fundamental reason for scheduling a project is to ensure that the deadline can be met and this is because most projects have a deadline constraints. Since the critical path basically describes the activities that will determine the end date, it also provides a guide on how the project should be managed. The project schedule therefore serves as a guide that can be used by the project manager and the project team in successfully completing projects. In a multiple-project environment, in addition to managing each project as a unit, one problem that a project manager would have to deal with is the management of numerous interdependencies and interactions among projects at various levels. However, project managers can do so by being innovative about methods of integrating the activities of planning/scheduling, monitoring/control and managing resources of diverse projects in order to collectively manage them (Bakkins, 2010).

There is the issue of delays on construction projects too. One of the most recurrent problems in delivering projects in the construction industry is delays (Al-Kharashi and Skitmore, 2009). The repercussion of delays affects all people and organisations involved in the project (both on the side of the buyer and seller). Additionally,

contractors that fail to complete projects within stipulated contract periods stand the risk of struggling to obtain new contracts given the characteristically high competition in the construction industry (Romel *et al*., 2015). Suffice to state that, in developing countries where the construction of public assets, such as schools hospitals etc. are usually urgently needed, delays result in social harm to those on the delivering and receiving end alike. The earlier those projects are completed, the better for satiating the social needs in such places (Al-Kharashi and Skitmore, 2009). In preventing the aforementioned problems, contractors ought to apply the processes prescribed by proper project management practice that lead to delivering construction projects successfully (CIOB, 2002).

In solidarity with the need to avoid delays and to effectively manage project schedules, the PMBOK® Guide Sixth Edition dedicates one knowledge areas out of ten, to project schedule management, which encapsulates the processes essential to achieve well-timed completion of projects [PMI, 2017]. Project schedule management includes processes such as "plan schedule management, define activities, sequence activities, estimate activity durations, develop schedule and control schedule". It could be deduced that any efforts (manual or automated) that would be channelled into carrying out these processes effectively would be aiming at achieving timely completion of projects. Conversely, any mismanagement of any of those processes could be derailing the timely completion of projects. It is in this light that the effect of employing automated methods (scheduling software) has therefore been explored in this research.

1.2 Problem Statement

According to the Project Management Body of Knowledge (PMBOK® Guide) 6th Edition a project manager is expected to perform forty-nine (49) processes, including twenty-four (24) planning processes. Therefore, planning processes make up about 49% of all processes that should be performed by a project manager during the project life cycle, albeit iterative. That is almost half of the total project management processes prescribed by the Project Management Institute. It gets more complicated knowing they are typically iterative in a project life cycle (PMI, 2017).

Kerzner (2009) expressly states that, "efficient project management requires more than good planning, it requires that relevant information be obtained, analysed, and reviewed in a timely manner. This can provide early warning of pending problems and impact assessments on other activities, which can lead to alternate plans and management actions. Today, project managers have a large array of software available to help in the difficult task of tracking and controlling projects. While it is clear that even the most sophisticated software package is not a substitute for competent project leadership—and by itself does not identify or correct any task related problems—it can be a terrific aid to the project manager in tracking the many interrelated variables and tasks that come into play with a project".

Elonen and Artto (2003) point out that, organizations that are engaged in many projects (typical of construction firms), have the challenges of adequate resource planning, prioritization and monitoring to contend with. These could found in several problematic areas. One of such is, failing to balance resources adequately which are oftentimes scarce, introduces further pressure on the organization, and that culminates

in spending more time to complete the project. Another of such problems is managers becoming overwhelmed by the enormity of information obtainable to make decisions. They may not be able to identify the applicable information or even realize the inaccuracy or imprecision of the information if any (Marjolein *et al.* 2012). Project managers as well as other stakeholders should therefore effectively understand how to bridge the gap between planning and scheduling theories and their practical applications. Kerzner (2009) then argues from a project management perspective, that a successful project should essentially satisfy the following criteria:

- Completion within the planned duration and cost;
- Implementation at the stated degrees of project performance;
- Delivery according to the needs and expectations of project stakeholders
- Completion within the specified scope as defined and agreed by all parties.

According to Alias *et al*. (2014), construction projects that turn out to be successful fundamentally place premium on successful project management practices particularly with regarding planning processes, implementation and cost, time (schedule) as well as quality achievements. In reality, however, we get to experience some shortcomings in the forms of deviations from agreed schedules and cost overruns (Altoryman, 2014; González *et al*., 2014; Kumaraswamy and Chan, 1998). Such shortcomings may be attributable to improper risk identification in project planning during the initial stages of projects (Hussein and Klakegg, 2014). These elicit efficient application of project management processes in general, and schedule management processes in particular, in planning and developing project schedules. Not much study has been conducted on the chosen topic and hence this study.

1.3 Research Question

Does the deployment of scheduling software on projects increase the efficiency of the project manager?

1.4 Research Aim and Objectives

1.4.1 Aim

This study aimed at reviewing the extent of scheduling software usage on projects.

1.4 2 Objectives

The study sought to:

i. Determine level of scheduling software deployment on the selected projects;
ii. Determine level of project management efficiency (from the perspective of schedule management) on the selected projects;
iii. Establish a correlation between scheduling software deployment and project management efficiency (from the perspective of schedule management); and
iv. Determine the extent of impact of scheduling software deployment on project management efficiency (from the perspective of schedule management).

1.5 Significance of Study

The need to efficiently manage project schedules has become increasingly important over the years. There is even a greater need to manage project schedules more efficiently. Clients and other stakeholders who may not necessarily be Project Management Professionals are increasingly becoming aware of the project environment and hence the need to receive up-to-date project information for prompt decision making and other reasons. Schedule management is pivotal in project

success. If the application of software on projects in Ghana could help in better managing this aspect of projects, it is worth pursuing and hence the study.

1.6 Research Scope

This project considered only construction projects within the Accra Metropolitan area. The geographical limitation was so because being the capital of Ghana, the level of construction activity is significant enough to represent what happens in the country generally. The project selection was based on contract prices (above GHø1m) and physical complexity. These were informed by the researcher's experience in the construction industry to predict the likelihood of software deployment on projects. The defined projects, in the researcher's estimation were deemed to be proportional to the level of expertise of the personnel managing various aspects of the projects, particularly, project schedules.

1.7 Brief Methodology

The study began by reviewing available literature on the topic. Questionnaires were developed to solicit data from project management professionals and/or persons performing project management functions within the Accra metropolitan area which were analysed afterwards. The researcher drew on the experiences of as many professionals as possible via his social and professional networks where necessary.

1.8 Structure of Thesis

Chapter 1: This chapter gives a general overview of the research, regarding project management in the broad sense, planning and then scheduling. A brief description of

the research context follows, then the problem statement, study objectives and then it finally presents the structure of the thesis.

Chapter 2: Present a background to the research in a theoretical context. It captures an overview of available literature and previous studies conducted in the research area, followed by an introduction to historical perspectives of project scheduling, contemporary practice and its benefits to construction projects. The final part of this chapter focuses on scheduling software usage, features of scheduling software, its benefits as well as some disadvantages.

Chapter 3: Covers the philosophy underpinning the research and design, a description of the theoretical aspects of the approaches adopted, research methods and the data collection strategy.

Chapter 4: Basically summarizes the findings from the research, analyses and also briefly discusses the findings.

Chapter 5: Presents the conclusions arrived at from the study, the main contributions and makes recommendations for further research.

1.9 Conclusion

This chapter has provided an introduction to the research and outlined the justification for the study, the objectives, the methodology employed in data collection and then finally, the structure of the thesis. The subsequent chapter presents a literature review

on the information available from previous research carried out in the area of schedule management and the use of scheduling software in projects.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Individuals and organisations are involved in implementing new undertakings at one time or the other. These endeavours are endless; developing a new product or service; establishing a new production line, organising a wedding ceremony, organising elections, medical outreaches, product promotion campaigns or a major building project. Project management therefore becomes an important tool for organisations that understand its use and have the aptitudes to appropriate it to their undertakings. (PMI, 2017)

The term 'project', as used in this research, refers to "a temporary endeavour undertaken to create a unique product, service or result. Project management also refers to the application of knowledge, skills, tools and techniques to project activities to meet project requirements" (PMI, 2017). Ahleman (2009) defines project management as including all processes that are related to planning, controlling and coordinating projects. In practice, project management could get a bit sophisticated given the complexity, various uncertainties and multiplicity of activities involved in one project. According to the Project Management Body of Knowledge (PMBOK® Guide) Sixth Edition, out of the forty-nine (49) processes a project manager is expected to perform during the project life cycle, five (5) out of the twenty-four (24) planning processes relate to the schedule management knowledge area.

2.2 Evolution of Project Management Practice

2.2.1 Four Periods of Project Management

Snyder and Kline (1987) record that the modern project management era started in 1958 with the development of Critical Path Method/Programme Evaluation and Review Techniques. Morris (1987) however presents an argument that project management originates from the chemical industry just prior to World War II. He further points out that project management is clearly defined as a separate discipline in the Atlas missile program, especially in the Polaris project. Some literatures link the origin of project management to Henri Fayol's (1916) five functions of a manager: to plan, organize, coordinate, control, and direct or command. Kerzner (2009) also observes that project management is an "outgrowth of systems management."

Carayamis *et al.,* (2005) have identified four periods to better capture the history of modern project management: prior to 1958, 1958 – 1979, 1980 – 1994, and 1995 to present. Table 2.1 summarizes the four distinctive periods

Table 2.1: Four Periods of Project Management

PERIOD	THEME
Before 1958	Craft system to Human Relations and Administration
From 1958 to 1979	Application of Management Science
From 1980 to 1994	Production Centre: Human Resources
From 1995 to present	Creating a New Environment

Source: Adapted from "The Story of Managing Projects" 2005, P2

2.2.2 Brief History and Contemporary Practice

It is recorded that since the Egyptian era (c. 3100-2686 BC) the practice of project management has been thousands of years old. However, organizations started applying systematic project management tools and techniques to complex projects about fifty years ago. In the 1950s, Navy employed modern project management methodologies in their Polaris project. During the 1960s and 1970s, Department of Defence, National Aeronautic Space Administration, and large engineering and construction companies employed project management principles and tools to manage large budget, schedule-driven projects. In the 1980s, manufacturing and software development sectors also begun to adopt and implement sophisticated project management practices. Fast-forward to the 1990s, different industries and organizations widely embraced project management theories, tools, and techniques (Carayannis *et al*., 2005).

Carayannis *et al*. (2005) also comment on contemporary times thus, "There is no doubt that organisations today face more aggressive competition than in the past and the business environment they operate in is a highly turbulent one. This scenario has increased the need for organisational accountability for the private and public sectors, leading to a greater focus and demand for operational effectiveness and efficiency. Effectiveness and efficiency may be facilitated through the introduction of best practices that are able to optimise the management of organisational resources. Modern project management practice requires the assistance of project management software. The modern project management practice is complicated to an extent that it cannot operate without the use of software."

However, they comment on the recorded history of project management thus, "Historians and dedicated scholars contributed to the project management history over the years. Most of the documents were written in narrative format that covered only a few aspects of project management. A set of standards will make it easy for the project management community to build its history in order to take advantage of lessons learned from the past. The literature reviews suggest that technology and advanced management tools strengthened the functions of the project office. More organizations are adopting and applying project management practices, tools and techniques to its various operations. Therefore, a permanent project supporting entity that provides comprehensive project management knowledge is needed. Advanced Internet and computer technology is assisting organizations support the needs of project management".

Kerzner (2009) adds to the discussion on contemporary practice; "As more industries accept project management as a way of life, the change in project management practices has taken place at an astounding rate. But what is even more important is the fact that these companies are sharing their accomplishments with other companies during benchmarking activities". He continues to point out some interest areas which continue to experience changing trends as follows:

i. The project management maturity model (PMMM)
ii. Developing effective procedural documentation
iii. Project management methodologies
iv. Continuous improvement
v. Capacity planning
vi. Competency models

vii. Managing multiple projects

viii. End-of-phase review meetings

Heagney, (2011: Pp 82-83) captures briefly some history of project scheduling in particular; “Until around 1958, the only tool for scheduling projects was the bar chart. Because Henry Gantt developed a complete notational system for showing progress with bar charts, they are often called Gantt charts. They are simple to construct and read and remain the best tool to use for communicating to team members what they need to do within given time frames. Arrow diagrams tend to be too complicated for some teams. Nevertheless, it is often helpful to show an arrow diagram to the people doing the work so that they understand interdependencies and why it is important that they complete certain tasks on time. Bar charts do have one serious drawback—it is very difficult to determine the impact of a slip on one task on the rest of the project. The reason is that the bar chart (in its original format) did not show the interdependencies of the work. (Contemporary software shows links between bars, making them easier to read. The actual name for these bar charts is “time-line critical path schedules.” This goes to underscore the essence and/or benefits of scheduling software deployment in modern project management practice. To overcome the difficulty of not being able to determine the impact of a slip on one task on the rest of the project, “two methods of scheduling were developed in the late 1950s and early 1960s, both of which use arrow diagrams to capture the sequential and parallel relationships among project activities. One of these methods, developed by Du Pont, is called Critical Path Method (CPM), and the other, developed by the U.S. Navy and the Booz Allen Hamilton consulting group, is called Program Evaluation and Review Technique (PERT). Although it has become customary to call all arrow diagrams

PERT networks, strictly speaking the PERT method uses probability techniques, whereas CPM does not. In other words, with PERT it is possible to calculate the probability that an activity will be completed by a certain date, whereas that is not possible with CPM. What is the benefit of using either CPM or PERT? The main advantage is that you can tell whether it is possible to meet an important project completion date, and you can also tell exactly when various tasks must be finished in order to meet that deadline. Furthermore, you can tell which tasks have some leeway and which do not. In fact, both CPM and PERT determine the critical path, which is defined as the longest series of activities (that can't be done in parallel) and which therefore governs how early the project can be completed" (Heagney, 2011: Pp 82-83)

Callahan *et al.* (1992) have found out that, the rapid growth in the availability and ever increasing power of microcomputers, coupled with their relatively decreasing cost, has made it possible for construction managers to efficiently analyse the massive levels of data necessary to monitor and control the progress of the many interrelated tasks that go together to make up a project. This has also enabled professional and technical staff to spend a greater proportion of their time on specific project-related tasks rather than on the rather mechanistic administrative tasks that can now be carried out more efficiently by computer. They add that, microcomputers have become commonplace tools in assisting project managers, planners and schedulers with the complex and time-consuming calculations involved in estimating activity durations, sequencing and determining overall schedule dates and other information related to the scheduling process.

2.3 Project Planning Vs Scheduling

According to Baldwin and Bordoli (2014), the definition of project planning from a construction perspective, has been considered across a broadly by researchers and practitioners alike. Pierce (2013) goes on to further define project planning as a set of recognized processes used to make a decision on what tasks must be performed to achieve the project's set objectives within agreed schedule and cost. Project planning can also be viewed as an iterative process or procedure used in project scope definition, developing and refining project objectives and determining the set of actions required to run a project according to specified quality standards. In fact the PMBOK Guide, 6th edition, lends some credence to this assertion with additional parameters to the quality standards. (Faniran *et al*., 1998; PMI, 2017). Baldwin and Bordoli (2014) further explain that irrespective of the definition one may be choose for project planning, it has the fundamental objective of meeting a number of criteria which include the generation of realistic schedules and costs, the completion of a project to defined quality standards, design criteria, available resources, health and safety, and meeting project stakeholders' expectations. They then comment on scheduling as being regarded as either an integral part of, or output from, project planning. The essence of the project schedule is also explained as providing the basis for measuring progress, the basis for regular reviews and updating of the plan. (Baldwin and Bordoli, 2014).

"Project scheduling is the application of skills, techniques, and intuition required through knowledge and experience to develop effective schedule models. The schedule model integrates and logically organises various project components, such as

activities, resources, and logical relationships, to enhance the likelihood of successful project completion within the baseline duration" (PMI, 2011).

Agyei (2015) asserts that, "Project planning and scheduling play a central role in predicting both the time and cost aspects of a project." In other words, to have fair idea of how much a project could cost or how timely completion could be achieved, one could assess how well it has been scheduled the to make an 'informed guess'. Kanik (2005) adds that, "Planning and scheduling are often inseparably connected. The plan defines what must be done and restrictions on how to do it while the schedule specifies both how and when it will be done."

The Practice Standard for Scheduling 2nd Edition explains that "projects are generally complex endeavours; however, a detailed schedule model may result in decomposing projects into manageable phases or groupings. Project performance is then reported and monitored when the progress against these activities and milestones is recorded. As progress is recorded on a project, the remaining effort requires reassessment. The execution of a project often does not proceed exactly as it was initially planned and baselined. In a typical project environment, because of inadequate planning or significant project changes, it becomes necessary to refine the schedule model. This iterative evolution is required to predict, recognize and address those evolving factors and issues that will potentially affect project performance. The key to project success is to apply knowledge and experience to create a project management plan and then commit to execute the project according to the plan. Scheduling is one of the basic requirements of project management planning and analysis. Scheduling provides a detailed plan that represents how and when the project will deliver the products,

services and results defined in the project scope and may serve as a tool for communication, managing stakeholder expectations, and as a basis for performance reporting. The dynamic nature of a project's execution is best served by a tool that allows modelling of the project internal and external dependencies, and analysis due to the impact of progress and unforeseen developments." (PMI, 2011).

The schedule model supports the project by allowing for time phasing of required activities, mobilization of required resources in a most efficient manner, coordination of events within the project and between the projects where multi-projects are concerned, early detection of risks or problems, implementation of measures to achieve the project objectives as planned, allowing for simulations or analysis of "what-if" scenarios, resource planning and forecasting of estimate at completion/ estimate to complete (PMI, 2011).

"Whereas planning has to be done well in order to define the best solution to deliver the project, scheduling needs to be done well to determine how long the project will take. Furthermore, it must be done well to communicate the project clearly and precisely. It can then form a sound foundation for project control. Scheduling is more of a science which usually involves the input of planning information into scheduling software. Scheduling uses the Work Breakdown Structure (WBS) as the framework on which to build all the project activities. It calculates the dates from the activity/task durations and determines the resources required. It also defines the logical sequence of activities and calculates the critical path (chain of activities which, if delayed, will cause a corresponding delay to the overall project completion date). In this process, it computes the start and finish dates and identifies the float on all the activities. The

final outcome of this process is to determine the feasibility of delivering the project to the required completion dates (Association for Project Management, 2015)".

2.4 Project Success and Project Management Efficiency

Kerzner (2009) asserts, "Historically, the definition of success has been meeting the customer's expectations regardless of whether or not the customer is internal or external. Success also includes getting the job done within the constraints of time, cost, and quality. Using this standard definition, success is defined as a point on the time, cost, quality/performance grid". A project is successful if it satisfactorily overcomes the constraints of time or schedule, cost, quality requirements, agreed scope, resources, and risks (Schwalbe, 2013). The PMBOK Guide 6th Edition adds the factor of Customer satisfaction. It is worthy of note that any adjustments in time being one of the critical components of the 'New Iron Triangle' which is a build-up on the traditional Cost, Scope and Time factors (as depicted in Figure 2.1), may have a resultant effect on Cost, Risk, Customer Satisfaction, Quality, Scope and other Resources. These parameters, should be looked at within the context of Project Management efficiency. Martinsuo and Lehtonen (2007), define efficiency from a project management perspective as projects succeeding in fulfilling its objectives. For the purpose of this study, project management efficiency will be considered purely from the perspective of schedule management. In other words, the success of projects and the efficiency of managers will be analysed from the lenses of processes that are required to ensure timely completion of projects; defining activities, sequencing activities, estimating activity durations, developing and controlling schedules.

Figure 2.1: 'New Iron Triangle'

Source: Adapted from the PMBOK Guide, 6th Edition (2017)

Kerzner (2009) defines project success to include completion:

- Within the allocated time period
- Within the budgeted cost
- At the proper performance or specification level
- With acceptance by the customer/user
- With minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organization
- Without changing the corporate culture

2.5 Scheduling Software

PC Plus (1993) states, "In common with most other business functions, the growing use of microcomputers has resulted in an unprecedented increase in the development and supply of bespoke software designed to fulfil specialised requirements. Accountancy, job costing and Computer Aided Designs are a small selection of specialised functions that software developers are providing specialised products for.

The functions of project management, planning and scheduling have also attracted the attention of software houses. These software houses are in the business of writing and producing programs which fulfil a basic requirement of a business function such as scheduling and project management. By no means can it be said that each and every software house which produces a scheduling or project management package will fulfil the requirements of each and every user. Certain packages may be more suitable for one application, user, or even industry, than another. This means that it is very much left to the user to make the decision as to which program to choose. This, of course, should be the case. Each user should select software which will be applicable to their own situation and should seek to optimise their selection at all times". PC Plus (1993) however admits that, this is relatively easy to implement in theory, but as there are numerous different project planning software packages on the market selecting one in particular may be very difficult.

The Practice Standard for Scheduling, 2nd Edition, captures the following scheduling software applications: Artemis, Finest Hour, Maximo, MicroPlanner, MS Office Project, Open Plan Professional, Oracle P6, PERTmaster, Parade, Primavera Project Planner (P3), Project Two, PS-Next, Risk+, RiskyProject, SureTrak and @Task. The extent of usage of these would be explored later in this research.

Conlik & Retik (1997) broadly summarize the characteristics or features of scheduling software as general, technical and specialist features which should help users in making their choices:

i. **General characteristics** which consist of the commercial name of the system, its list price, the name and address of the software house, and the sort of work for which it is designed.

ii. **Technical features** that allow the examination of particular features such as graphical presentation, modelling, resource assignment, resource scheduling, multi-project capability, tracking, cost allocation, report formats, data transfer capability, etc.

iii. **Specialist features** which help one to identify the specialist features that can be used in the specialized field of schedule management and which can be used in addition to the basic features required by most planning and scheduling software packages.

According to Kerzner (2009) and PMI (2011), the capabilities of project management software and features and/or functions vary. However, the variations are more evident in the complexity and superiority of the features, such as storage, graphical display, analysis, interoperability, and how user-friendly they could be, rather than in the type of features offered, which are quite similar for most software programs. The following are some common features of most project management software packages:

1. **Planning, tracking, and monitoring-** These features provide for planning and tracking the projects' tasks, resources, and costs. The data format for describing the project to the computer is usually based on standard network typologies such as the Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or Precedence Diagram Method (PDM). Task elements, with their estimated start and finish times, their assigned resources, and actual cost data, can be entered and updated as the project progresses. The software provides an analysis of the data and documents the technical and financial status of the project against its schedule and original plan. Usually,

the software also provides impact assessments of plan deviations and resource and schedule projections. Many systems also provide resource levelling, a feature that averages out available resources to determine task duration and generates a levelled schedule for comparison.

2. Reports- Project reporting is usually achieved via a menu-driven report writer system that allows the user to request several standard reports in a standard format. The user can also modify these reports or create new ones. Depending on the sophistication of the system and its peripheral hardware, these reports are supported by a full range of Gantt charts, network diagrams, tabular summaries, and business graphics. Reporting capabilities include:

i. Earned value analysis
ii. Cost and schedule performance indices
iii. Cash-flow
iv. Critical path analysis
v. Change order

In addition, many software packages feature a user-oriented, free-format report writer for styled project reporting.

3. Project calendar- This feature allows the user to establish work weeks based on actual workdays. Hence, the user can specify nonworking periods such as weekends, holidays, and vacations. The project calendar can be printed out in detail or in a summary format and is automatically the basis for all computer-assisted resource scheduling.

4. What-if analysis- Some software is designed to make what-if analyses easy. A separate, duplicate project database is established and the desired changes are entered. Then the software performs a comparative analysis and displays the new against the old project plan in tabular or graphical form for fast and easy management review and analysis.

5. Multi-project analysis- Some of the more sophisticated software packages feature a single, comprehensive database that facilitates analysis and reporting across a number of projects. Cost and schedule modules share common files that allow integration among projects and minimize problems of inconsistencies in data as well as some redundancies.

2.5.1 Classification of Software

Scheduling software could be categorised broadly under Proprietary Software and Open Source Software. Proprietary Software, once procured is licensed under the exclusive right of its owner. Of a necessity, they must be purchased to earn such rights. Open Source Software on the other hand are "free" and would not require purchasing agreements like the former. Again, user support is often limited and marketing of such software is non-existent. Open source software are often developed to mirror functionality of corresponding expensive proprietary ones. For example, OpenProj is an open source version of MS-Project.

Kerzner (2009) categorizes project management software into Level I, II or III based on the type of functions and features they provide for purposes of easy classification:

2.5.1.1 Level I Software

These are designed for single-project planning, these software packages are simple, easy to use, and their outputs are easy to understand. They tend to provide only a limited analysis of the data. They do not provide automatic rescheduling based on specific changes. Therefore, deviations from the original project plan require complete re-planning of the project and a complete new data input to the computer.

2.5.1.2 Level II Software

These are designed for single project management, these software packages aid project leaders in the planning, tracking, and reporting of projects. They provide a comprehensive analysis of the project, progress reports, and plan revisions, based on actual performance. This type of software is designed for managing projects beyond the planning stage, and for providing semiautomatic project control.

2.5.1.3 Level III Software

These packages feature multi-project planning, monitoring, and control by using a common database and sophisticated cross-project monitoring and reporting software. Most software packages at levels II and III have the following capabilities for effective project monitoring and control which are quite extensive:

1. **System Capacity-**The number of activities and/or number of sub-networks that may be used.
2. **Network Schemes-**The network schemes are activity diagram and/or precedence relationship.

3. **Calendar Dates**- An internal calendar is available to schedule the project's activities. The variations and options of the different calendar algorithms are numerous.
4. **Gantt or Bar Charts-** A graphic display of the output on a time scale is available if desired.
5. **Flexible report generator**- The user can specify within defined guidelines the format of the output.
6. **Updating-** The program will accept revised time estimates and completion dates and re-compute the revised schedule.
7. **Cost Control-** The program accepts budgeted cost figures for each activity and then the actual cost incurred, and summarizes the budgeted and actual figures on each updating run. The primary objective is to help management produce a realistic cost plan before the project is started and to assist in the control of the project expenditures as the work progresses.
8. **Scheduled Dates-** A date is specified for the completion of any of the activities for purposes of planning and control. The calculations are performed with these dates as constraints which are automatically factored into any calculations relating to dates.
9. **Sorting-** The program lists the activities in a sequence specified by the user. The user chooses which categories of activities to view and work with at a time.
10. **Resource Allocation-** The program attempts to allocate resources optimally using one of many heuristic algorithms.
11. **Plotter Availability**- A plotter is available to plot the network diagram.

12. **Machine Requirements-** This concerns the minimum memory of the hardware required for the program (in units of bytes).
13. **Cost-** Indicates whether the program is sold and/or leased and the purchase price and/or lease price (where available).

2.6 Benefits of Scheduling Software

PMI (2011) presents the scheduling tool as typically a software-specific tool that contains scheduling components and the rules for interrelating these components. Scheduling components are easily pictured by running a scheduling software application and observing the various features/functions in the scheduling tool that are available to build the schedule model. The scheduling tool is the platform upon which the schedule model is assembled and provides the means to adjust various parameters and components typical in a modelling process. The scheduling tool includes the capability to:

i. Select the type of relationship between activities
ii. Add lags and leads between activities
iii. Apply resources to the activities and use resource information along with resource availability to adjust the scheduling of activities
iv. Assign priorities to activities and utilize the same resource over the same period of time
v. Add constraints to activities where logic alone is not adequate to meet the project requirements, especially when considering external schedule drivers and resource availability.
vi. Capture a specific schedule model instance as a baseline

vii. Perform various what-if analysis scenarios within the schedule model to obtain different project completion dates

viii. Analyse how objectives of the project could be impacted by the impact probable changes to schedule.

ix. Compare the most recent schedule model instance against a previous schedule instance or against the approved baseline instance to identify variances and trends and quantify them.

Mubarak (2010) outlines the following benefits. Scheduling software:

i. Provides a consistent framework for replicable project successes

ii. Effectively illustrates the interdependence of all tasks

iii. Clearly indicates the expected dates that resources need to be available

iv. Determines milestone and project completion dates

v. Identifies activities on the critical path that if delayed will delay the completion of a project

vi. Identifies which activities are not on the critical path and hence can be delayed if necessary without adversely affecting the project completion date

vii. Identifies availability of resources

viii. Shows which tasks can or are being done in concurrently

ix. Creates a consistent framework which can be followed from one project to another and in the course of executing the project

x. Illustrates the interdependencies of individual activities on the work breakdown structure

xi. Facilitates communication within the project team and between the team and stakeholders

xii. Aides in the analysis of the critical path

xiii. Aides the project manager to evaluate all alternatives and their impact when introducing changes to project schedules during the project

xiv. Reduces the amount of conflicts in scheduling resources

xv. Provides visibility to those tasks that can or must be executed concurrently to keep the project on track

xvi. Facilitates analysis of "what-if" scenarios

Software usually seek to enhance the completeness, accuracy, reliability, timeliness and appropriateness of information used in decision-making. On the whole, scheduling software basically provides scientific information to project team members regarding expected finish dates, prediction and calculation of cashflow, serves an effective monitoring tool and helps project managers to evaluate the effect of changes especially relating to budget and completion targets which are mostly critical indicators of project success.

2.7 Disadvantages of Using Software in Project Management

The deployment of technology in scheduling is likely to bring up certain risks that would have to be handled in maximising the benefits thereof. As commonly associated with the use of equipment and applications, software and hardware defects readily surface. In setting criteria for choosing particular software, certain aspects would always leave room for some risk to show up. For instance, it could be realized half way through a project that, the cloud service provider doesn't satisfy one's set benchmarks for performance. There could also be issues with the platform used to

build the software or software update of a critical tool that no longer supports some functions/features of the software (Viswanathan, 2015).

2.7.1 Complication of Simple Projects

Brandenberg (n.d.) explains that, some project scheduling tools tend to somehow complicate even simple projects. The software may recommend more steps than may be necessary to get the job done. Some do not allow much room for flexibility, which is necessary when it comes to real world practice. Projects will inevitably have delays that are out of your control, and you need to be able to make changes and some tweaks as necessary. Unnecessary complication of simple projects could be attributed to the inappropriate use of software.

2.7.2 Cost

The cost of project management software could be an advantage or otherwise depending on the type of tool one procures. Two broad categories of software could be web-based and desktop software. Web-based project scheduling tools, also known as Software as a Service popularly referred to as SaaS, typically, do not require payment upfront, such as purchasing a license for the software. You can just subscribe and pay a monthly fee depending on the number of users. On the other hand, desktop software is installed on your network server or on a single user's hard drive. It requires a the payment of licensing fees and may cost some hundreds of thousands of dollars depending on the specific features required and the scope of the software (Hooks 2013).

2.8 Conclusion

This chapter has looked at the history of project management through to contemporary practice, the types of scheduling software available, the benefits one could derive from deploying scheduling software on projects as well as some associated disadvantages. Chapter two reviewed available literature for scheduling using automated methods and the key issues were extracted. It's been realized that there are different levels of software deployment depending the extent to which certain features are used. Based on the literature reviewed, it was realized that it is advantageous to manage numerous activities, assign resources, sequence activity interdependencies and have a significant control over other schedule management processes. Chapter three presents the methodology adopted by the researcher.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods that have been used in the collection and analysis of data to validate the hypothesis of the study or otherwise. It explains the research design, sampling techniques and data collection methods used; and describes how data collected from the research has been analyzed. In conducting this research, both qualitative and quantitative research methods have been used.

"Quantitative - as the name suggests, is concerned with trying to quantify things; it asks questions such as 'how long', 'how many' or 'the degree to which'. Quantitative methods look to quantify data and generalise results from a sample of the population of interest. They may look to measure the incidence of various views and opinions in a chosen sample for example or aggregate results.

Qualitative – concerned with a quality of information, qualitative methods attempt to gain an understanding of the underlying reasons and motivations for actions and establish how people interpret their experiences and the world around them. Qualitative methods provide insights into the setting of a problem, generating ideas and/or hypotheses" (Walliman 2011).

Structured questionnaires were used in collecting quantitative data, based on which any evaluation of responses has been done.

3.2 Research Setting

The study was conducted on some selected projects and by extension, the managers of such projects in Accra to represent projects in Ghana. Accra was chosen because of: Level of construction activity which is representative of what happens in the entire country. Every kind of construction activity in terms specialty, complexity and budget can be found in the Accra metropolitan area.

3.3 Research Design

Yin (1994), describes a research design as a plan that guides the researcher in the processes of gathering, analyzing as well as interpreting observations. It is a logical model of proof that affords the researcher room to infer from causal relations among the variables being investigated. The research design covers sampling techniques and methods of collecting data as used in the research. It is the actual structure or outline that shows the period within which data will be collected, and the number of groups that will be involved (Edmonds & Kennedy, 2012). These are explained in this chapter.

3.4 Population

Walliman (2011) describes population in research as a term used to describe the total quantity of things (or cases) of the type which are the subject of one's study. A research population basically describes the target group. All individuals or objects within a certain population usually have some shared characteristics or traits. In this study, all persons who play project management roles on projects were targeted, and not necessarily people who are scheduling experts nor certified project managers. The researcher's experience in the Ghanaian construction industry guided this strategy.

The registry of certified project managers available on the Project Management Institute website (https://www.pmi.org) does not provide a list for the purpose of population estimation. One can only view a member at a time, knowing their specific full names. It therefore did not afford the researcher the room to know the entire number of certified project managers plying their trade within the Accra metropolitan area. The population size for the study was thirty-five (35).

3.5 Sample Size and Sampling Techniques

The general aim of all sampling methods is to obtain a sample that is representative of the target population. The researcher used purposive type of non-probability sampling as well as snowballing. Neuman (2000) describes purposive non-probability sampling as making use of experts who work with the prospective study areas to get educative cases which contain useful information. In this study, the researcher found this method appropriate due to the nature of the exploration carried out.

Sample refers to the part of the population which is drawn to represent what the whole is like (Naoum 1998). He further explains that the selection of samples for interviews is very important and must be carefully done to ensure that the sample characteristics representative of those of the population. Generally, this is done in either a random or non-random manner. For this study, snowball sampling was employed. The participants selected were the ones who were likely to be associated with schedule management processes in their projects particularly in the usage of scheduling software.

The selection of projects for study was considered from two parameters: complexity of project (Gross floor area above 2000sqm), contract sum above GHS1million. The researcher's experience informed this selection in order to find respondents who are likely to have any level of working idea of scheduling software. Four of such projects were identified. Therefore respondents who participated in this research were professionals who are currently working on construction projects that meet these criteria. With the initial contacts established via the researcher's professional network, a snowballing method was used to identify other possible respondents until thirty-five (35) were identified and served with questionnaires whilst 30 responded by the time the researcher needed the feedback. That translates into an 86% response rate.

3.6 Sources of Data

Two different types of data were used. These were primary and secondary data. Data were collected through the administering of questionnaires to construction industry players. This data used for analysis formed part of the primary data while the secondary data was sourced from various online search engines, books, journals and various publications in project management and software development.

3.7 Data Collection Instrument

The study made use of self-administered questionnaires to collect data from the participants. A questionnaire was designed and used to collect relevant data from the selected sample. The questionnaire was in two parts: Sections A and B.

Section A collected information on demography of respondents whilst **Section B** gathered information about the levels of exposure of the respondents to scheduling

software as well their usage on projects they have managed/ are managing. It also sought to draw on the experiences of respondents in using scheduling software applications to help in better appreciation of the relationship between such practices and the levels of efficiency of project managers on projects.

3.8 Data Collection Procedure

The researcher sent electronic versions of the designed questionnaire via electronic mails to construction industry players, some of which are within the researcher's social and professional network. Following the principle of the snowballing, upon referral, others who are outside these networks but met the selection criteria were also served through the same means. On the average, it took five (5) working days for respondents to submit their filled out questionnaires. Hence, in one week, data collection was carried out.

3.9 Ethical Considerations

Initially, the purpose of the study was explained to the participants verbally. The participants were then given the questionnaires (see Appendix I), which also explained the purpose of the study. Confidentiality and anonymity were assured. Respondents, after being assured of the confidentiality of the data they would provide, were allowed to go through the questionnaires and give feedback on when they would be submitted.

3.10 Data Analysis

Data collected were screened, coded and entered into the Statistical Package for Social Sciences (SPSS) version 16.0 for windows. Basically, descriptive statistics were used in analysing the data with tables and charts used in presentation.

3.11 Conclusion

This chapter focused on the methodology that was used in this study. The basis for the choice of quantitative approach for data collection and analysis was given. Measures followed during the data collection were discussed in this chapter and the information about the sample was provided.

CHAPTER FOUR

RESULTS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter deals with the analysis and interpretation of the responses from questionnaires. It therefore gives detailed information on the demographic background of the respondents and assesses the levels of scheduling software deployment, as well as the effect of scheduling software usage on project schedule management in some selected projects in Accra.

4.2 Data Presentation and Analysis

Responses to questions are presented in tabular and in pictorial forms using graphs. For clearer understanding, further explanations are offered where needed.

4.2.1 Demographic Background of the Respondents

Figure 4.1 shows the Years of work in the construction industry, from the figure, 94% said they had spent between 5 to 10 years while 6% said they had spent 11 to 15 years.

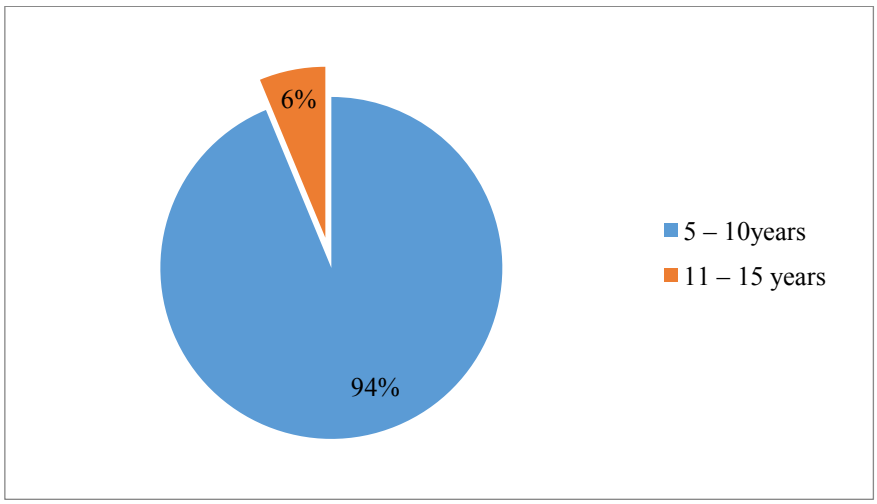

Figure 4.1 Years of Work in the Construction Industry

Figure 4.2 displays responses on the Years of work in the current company and the figure shows that 63% had spent between 5 to 10 years while 37% had spent less than 5 years working for the company.

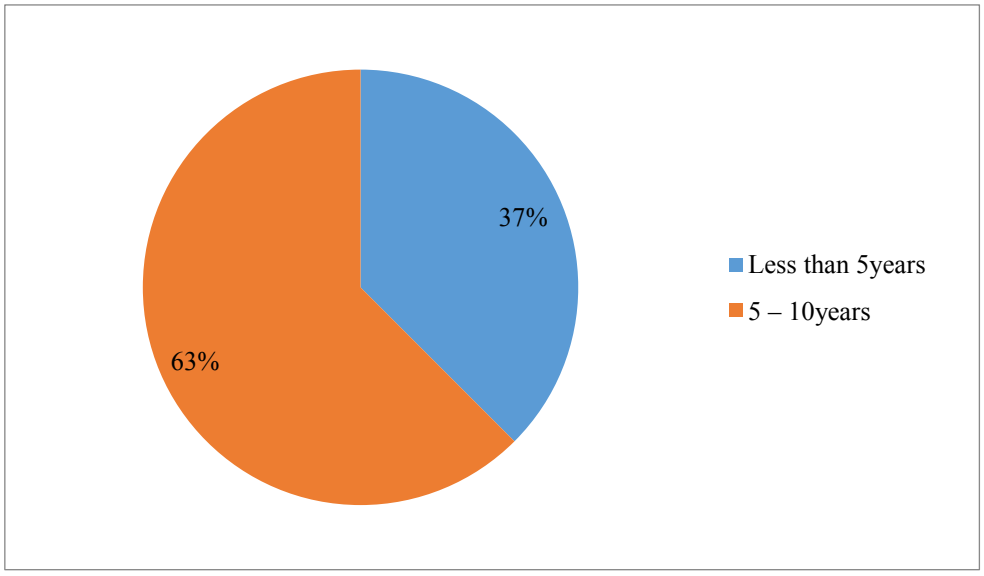

Figure 4.2 Years of Work in the Current Company

The professional inclination of the respondents as displayed in Figure 4.3 were Quantity surveyors (44%), Engineers (29%), Project Managers (12%) as well as Architects (6%) among others.

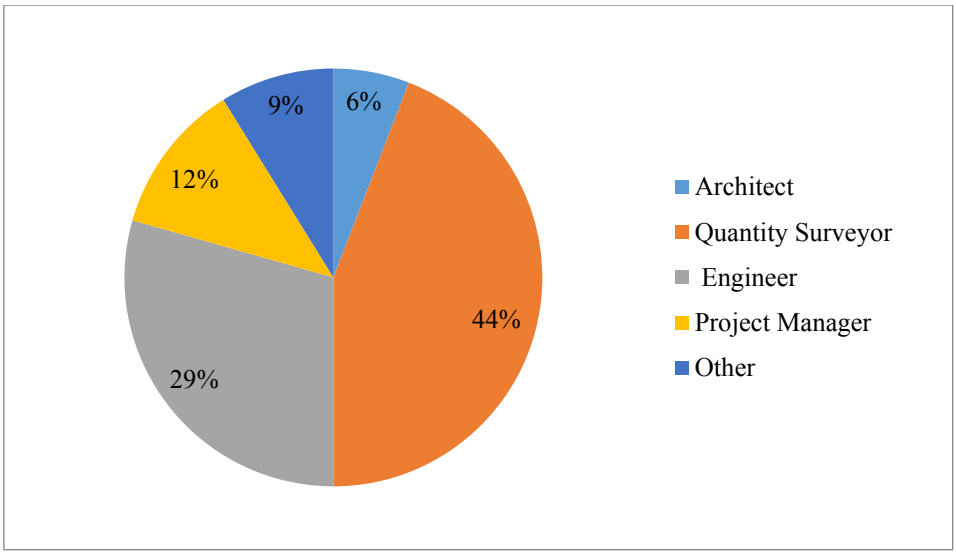

Figure 4.3 Professional Inclination

The highest educational level confirmed by respondents was the Master's Degree (22%) and Bachelor's Degree (78%) as shown in Figure 4.4.

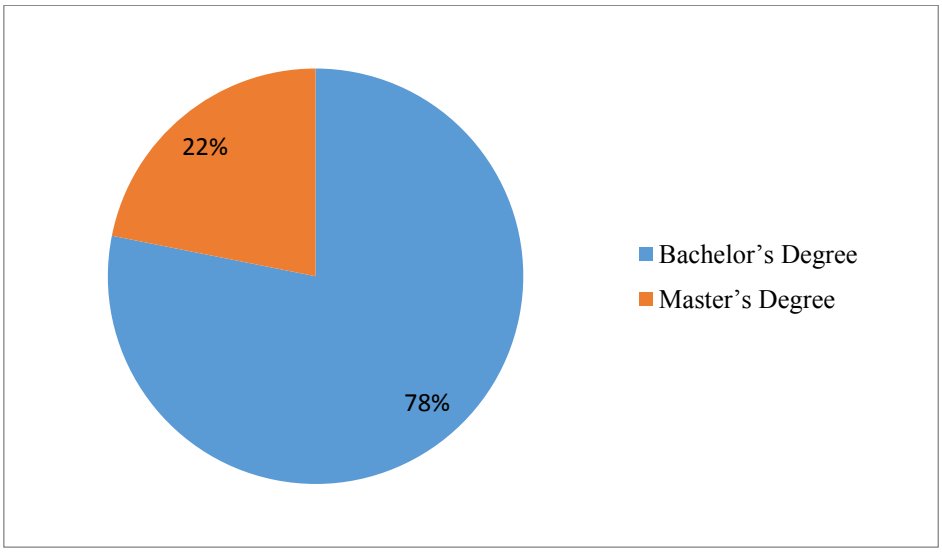

Figure 4.4 Highest Level of Education

Figure 4.5 shows Space the Company operates within the construction industry. From the figure, more than half (62%) were contractors, 22% were consultants and 16% were end-users. This aspect of demography was necessary to capture the experiences of professionals operating from different facets of the construction industry.

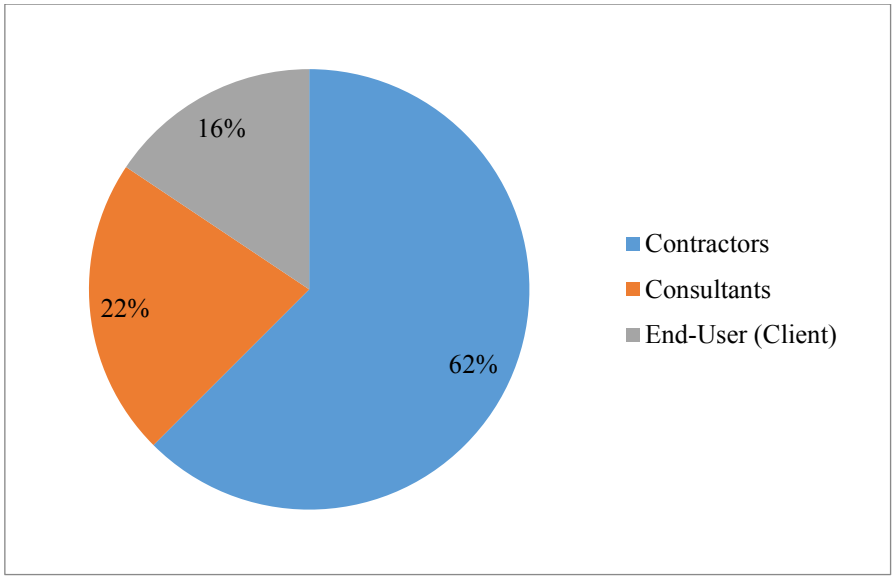

Figure 4.5 Space Company Operates within the Construction Industry

4.2.2 Project Management Certification & General Awareness of Scheduling Software

Table 4.1 displays responses on Scheduling Software Usage on Projects. From the table, those who were not Certified Project Managers were the majority (94%) and a few of the respondents (6%) had PMP as the Project Management Certification held. Also, all of the respondents (100%) performed project management roles in the organization with or without any Project Management Certification. Only a small number of the respondents (16%) indicated that their current company procured scheduling software for its operations.

The majority (93%) of the respondents indicated that they have Installed scheduling software on their personal computer for your use and also indicated that most (80%) between 3 to 5 of their Colleagues also have scheduling software installed on their personal computers. All the respondents (100%) indicated that they have the ability to use the scheduling software in managing projects. The extent of usage would be analysed later in this chapter. Only a few (7%) had exclusive rights to usage of scheduling software.

This finding appears to lend some credence to Heagney (2011) who asserts that "People today tend to acquire scheduling software, of which there is an abundance, and think that will make them instant project managers. They soon find that that idea is wrong. In fact, it is nearly impossible to use the software effectively unless you understand project management (and scheduling methodology in particular)."

Table 4.1 Project Management Certification & General Awareness of Scheduling Software

Variables	Characteristics	Frequency (n=422)	Percentage (%)
Certified Project Manager	Yes	2	6.00
	No	30	94.00
Project Management Certification held	PMP	2	6.00
	None	30	94.00
Perform project management roles in the organization	Yes	32	100.00
Current company procured a scheduling software for its operations	Yes	5	16.00
	No	27	84.00
Installed any scheduling software on personal computers for use	Yes	25	93.00
	No	2	7.00
Other Colleagues also having scheduling software installed	Less than 2	1	4.00
	3 – 5	20	80.00
	6-10	4	16.00
Ability to use the scheduling software in managing projects	Yes	30	100.00
Have exclusive rights to usage of scheduling software	Yes	2	7.00
	No	28	93.00

Source: Author's survey, 2018

Table 4.2 shows that majority of the respondents (83%) had spent 5 to 10years using scheduling software. A number of employees in the firm who are able to use the scheduling software were stated by most of the respondents as 3 to 5 (80%) and more than half (60%) had received training on usage by their current company. Others (67%) also received previous training elsewhere on the usage of the scheduling software. The Procured software cost was usually $1,000- $5,000 as indicated by

most (67%) of the respondents. Other information on Scheduling Software Usage on Projects (see Table 4.2).

Table 4.2 Scheduling Software Usage on Projects

Variables	Characteristics	Frequency (n=422)	Percentage (%)
Years of using scheduling software	Less than 5years	5	17.00
	5 – 10years	25	83.00
Number of employees in the firm who are able to use the scheduling software	Less than 2	1	3.00
	3 – 5	24	80.00
	6-10	5	17.00
Received training on usage by your current company	Yes	12	40.00
	No	18	60.00
Received previous training elsewhere on the usage of the scheduling software	Yes	20	67.00
	No	10	33.00
The company having exclusive rights to the usage of the procured software	Yes	2	67.00
	No	1	33.00
Procured software cost	$1,000- $5,000	2	67.00
	No idea	1	33.00
Procured Software expensive	Yes	1	50.00
	No	1	50.00
Play any role in the maintenance of the software	Yes	5	17.00
	No	25	83.00

Source: Author's survey, 2018

Figure 4.6 shows the Level of proficiency in the usage of the scheduling software among respondents and the results indicates that majority (73%) were moderately proficient while a small number (17%) were below average and proficient (10%). This implies that a handful of respondents were proficient in the use of scheduling

software. The levels of proficiency were corroborated by follow up questions which sought to know the extent of understanding/usage of certain functions/ features of scheduling software. These would reflect later in this chapter.

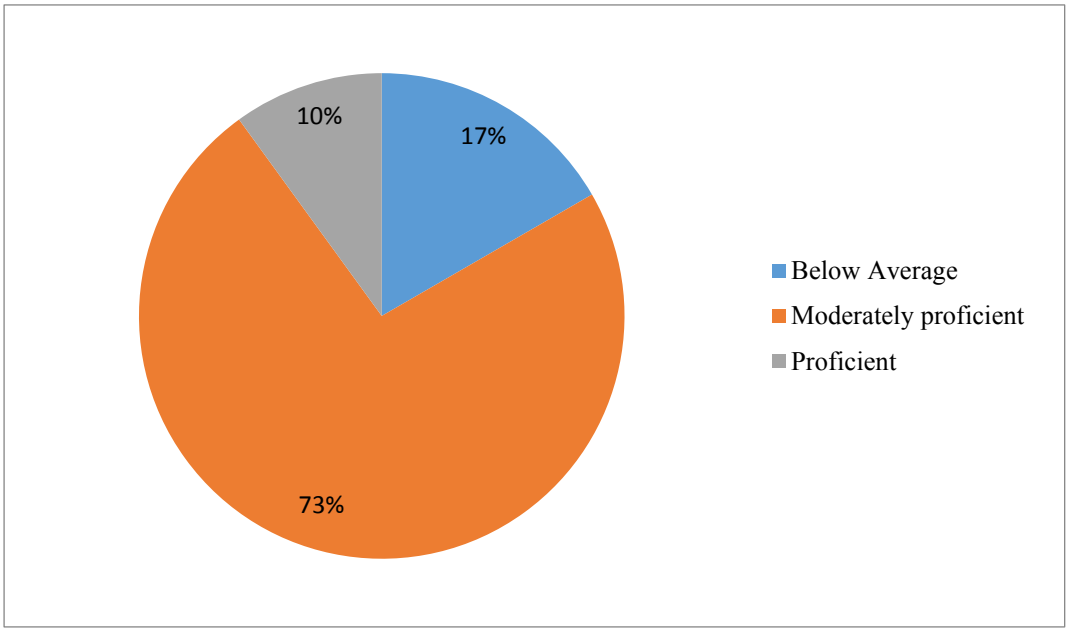

Figure 4.6 Level of Proficiency in the usage of Scheduling Software

Table 4.3 shows the activities and training related to maintenance of software in the selected company. From the table, all (100%) indicated that they have not received any training in maintaining the software. On the other hand, one had received training on the use of other scheduling software apart from the one being used by the current company. The majority (94.0%) of the respondents indicated that the other software being used by their company aside scheduling software Primavera Project Planner (P3) while few (6.0%) mentioned Project Two as the other software being used by their company aside scheduling software. Respondents indicated that they have not noticed any security flaws in the scheduling software the company uses and they would recommend the scheduling software to another company.

Table 4.3 Activities related to Maintenance/usage of Scheduling Software

Variables	Characteristics	Frequency	Percentage (%)
Received any training in maintaining the software	Yes	0	0.00
	No	30	100.00
Received any training on the usage of any other scheduling software apart from the one being used by the current company	Yes	1	3.00
	No	29	97.00
Aware of other Scheduling software apart from the one currently being used	Primavera Project Planner (P3)	30	94.00
	Project Two	2	6.00
Noticed any security flaws in the scheduling software company uses	Yes	0	0.00
	No	30	100.00
Recommend use of scheduling software to another company	Yes	30	100.00
	No	0	0.00

Source: Author's survey, 2018

Figure 4.7 shows the maintenance activities undertaken periodically and from the figure 21% were involved in Running antivirus and spyware scans; Backing up stored files and Cleaning dust from their computer while 18% were involved in Cleaning up their Operating System and Cleaning up the cabling while 1% was involved in adding or deleting users from a system, or modifying user rights and properties. This implies that respondents are engaged in different activities when it comes to maintenance of software**,** albeit not extensive.

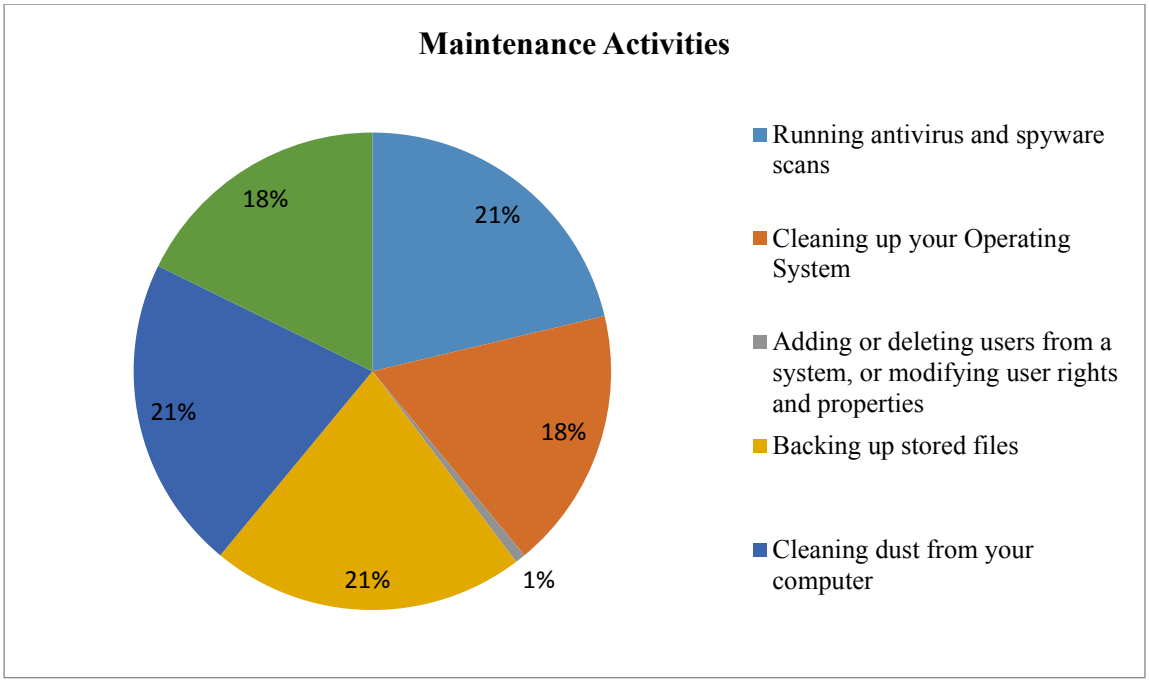

Figure 4.7 Maintenance Activities undertaken periodically

4.3 Scheduling software & Project Management Efficiency

The respondents indicated their level of agreement with statements on the effects scheduling software on the efficiency of schedule management processes they undertake on a Four Point Likert Scale. The range was 'strongly disagree (1)' to 'strongly agree' (4). The mean scores of 0 to 2.5 on the continuous Likert scale;(0 to 2.4) have been taken to represent a response of strongly disagree and disagree by the majority of respondents and the score of both agree and strongly agree have been taken to represent a variable which had a mean score of 2.5 to 4.0 on a continuous Likert scale; (2.5 to 4.0). A standard deviation of >1.0 implies a significant difference in responses to a particular statement among respondents. The results are shown in Table 4.4.

Table 4.4 Scheduling Software and Project Management Efficiency

Statement	Mean	Std. Deviation
The deployment of the scheduling software enables me to better sequence activities	4.00	0.00
The deployment of the scheduling software enables me to better estimate activity durations	4.00	0.00
The deployment of the scheduling software enables me to accurately develop schedules	4.0	0.00
The deployment of the scheduling software enables me to better control schedules	3.81	0.02
Using scheduling software I work faster at generating schedules	4.00	0.01
The usage of scheduling software on simple projects make them look complicated	4.00	0.02

Source: Field survey, 2018

Table 4.4 shows respondents agreement level on statements related to scheduling software and from the table respondents unanimously agreed to the statements that deployment of the scheduling software enables them to better sequence activities (Mean=4.0); The deployment of the scheduling software enables me to better estimate activity durations (Mean=4.0) and the deployment of the scheduling software enables me to accurately develop schedules (Mean=4.0).

Majority of the respondents also agreed that the deployment of the scheduling software enables them to better control schedules (Mean=3.811) while states such as Using scheduling software I work faster at generating schedules (Mean=4.0) and the use of scheduling software on simple projects make them look complicated (Mean=4.0) had a unanimous agreement level.

It has been established from the responses in Table 4.4 that respondents agree the deployment of scheduling software on projects enhances their efficiency in the context of the parameters measured; sequencing activities, estimating activity durations, developing schedules and controlling them. These are the processes required to be undertaken to carry out schedule management on projects. The extent of impact of scheduling software deployment on project management efficiency is evident in the high mean scores. Even though respondents seem not have fully utilized the features of scheduling software, they are largely aware of the extent of impact that could have on their efficiency.

4.4 Usage of Features of Scheduling Software

The respondents indicated their level of proficiency on Uses and Features of Scheduling Software on a Five-Point Scale. The range was 'Not Conversant (1)' to 'Very Conversant ' (5). The mean scores of 0 to 2.5 on the continuous Likert scale ;(0 to 2.5) have been taken to represent a response of not conversant and below average by the majority of respondents. The scores of 'Moderately Conversant' have been taken to represent a variable with a mean score of 2.5 to 3.4 on the continuous Likert scale: (2.5 to 3.4) and the score of both Conversant and Very Conversant have been taken to represent a variable which had a mean score of 3.5 to 5.0 on a continuous Likert scale; (2.5 to 4.0). A standard deviation of >1.0 implies a significant difference in responses to a particular statement among respondents. The results are shown in Table 4.5

Table 4.5 Usage of Features of Scheduling Software

Statement	Mean	Std. Deviation
Cost Planning	2.62	0.99
Tracking Progress	3.50	0.51
Earned Value Analysis	2.00	0.82
Resource Allocation	2.17	0.70
Critical Path Analysis	3.00	0.59
Cash flow forecasting	2.00	0.77
Cost and Time Change Management	1.83	0.70
Data Integration with other software packages	1.76	0.63
Macros	1.10	0.40
Networking mode	1.67	0.48
What-If-Analysis	1.33	0.48
Multi-Project Analysis	1.47	0.63
Sorting	1.67	0.76

Source: Field survey, 2018

Table 4.5 shows the Usage of Features of Scheduling Software. From the table, respondents were Moderately Conversant with Cost Planning (Mean=2.62) and Critical Path Analysis (Mean=3.0). Respondents were conversant with Tracking Progress (Mean=3.5).

Respondents were not conversant with Cost and Time Change Management (M=1.83), Data Integration with other software packages (M=1.76), Macros (M=1.1), Networking mode (M=1.67), What-If-Analysis (M=1.33), Multi-Project Analysis (M=1.47), Sorting (M=1.67), Earned Value Analysis (M=2.0), Resource Allocation (M= 2.17) and Cash flow forecasting (M=2.0).

The range of the mean scores reveal the extent of scheduling software usage of projects. Largely, respondents were very familiar with tracking progress of work and satisfactorily, cost planning. That places a majority of scheduling software users under level I functions where software users stick to software packages that are simple, easy to use, and their outputs are easy to understand. It could be, however that, respondents have restricted themselves to these features which are basic functions in level II software (Kerzner, 2003; Author's Survey, 2018)

It also reveals the level of scheduling software deployment on the selected projects which was one of the objectives. The level of project management efficiency on the selected projects was looked at within the context of sequencing activities, estimating activity durations, developing schedules and controlling schedules.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions drawn from the data analyzed, some recommendations and also outlines the limitations and suggests further areas of study following the findings of this research.

5.2 Conclusions

This study has so far focused on timely delivery as a critical measure of project success. A project fundamentally is described as a temporary endeavour. This translates into projects having definite start and finish times. To live up to this uniqueness, one must be able to adequately monitor project schedule at any given time throughout the life of the project. From the researcher's experience, there appears to be a challenge in the construction industry in the manner in which physical progress of projects is reported. Sometimes it takes time for manager to fully or even inadequately ascertain the physical status of progress which may be vital information needed by stakeholders for decision making.

This study aimed at reviewing the extent of scheduling software usage on some selected construction projects within the Accra metropolis. It was discovered that generally, a majority of professionals perform project management functions as added functions and do not have the requisite certification to make them qualified (professional) project managers. The usage of scheduling software on the projects studied was not extensive enough. This is corroborated by the following finding:

Out of thirteen stated functions of schedule software, respondents were quite familiar with three; namely, Cost Planning (Mean=2.62), Critical Path Analysis (Mean=3.0) and Tracking Progress (Mean=3.5) out of a possible mean score of 4.0. These were the three most highly ranked among the rest with the least being Macros (Mean=1.10). Staying within the confines of these stated functions, and assuming that the 3 functions are deployed fully, one could suggest that 3 out of 13 represents 23% usage which is less than a quarter.

- The first objective was to determine level of scheduling software deployment on the selected projects

Out of thirteen (13) functions or uses of scheduling software, a maximum of three (3) were being utilized with a mean score of approximately 3.0 out of a possible 5.0. The rest were 2.0 and below. The three; tracking of progress, critical path analysis and cost planning are only three functions; there are a lot more that should be explored and utilized to derive optimum benefits.

- The second objective was to determine level of project management efficiency on the selected projects

The level of project management efficiency as stated earlier in the study, was considered only from the perspective of schedule management; the ability to go through the schedule management processes with the desired levels of accuracy and in good time. This is closely linked to the usage of maximising the deployment of automated methods in developing, managing and controlling the complex interdependencies between the numerous activities on project schedules so the project

manager can focus on other specific project-related assignments without expending administrative time on manual means.

- The third objective was to establish a correlation between scheduling software deployment and project management efficiency

A majority of the respondents agreed to the deployment of software on projects enabling them to better sequence activities, estimate activity durations, develop schedules faster and control them in the life time of projects. The highest mean score of 4 reflected in all but one of these parameters.

- Lastly, the study sought to determine the extent of impact of scheduling software deployment on project management efficiency

This is also closely linked to the correlation between scheduling software deployment and project management efficiency. Once respondents rated that high in the parameters presented to them, it stands to reason that they agree largely to the impact scheduling software deployment could have on their efficiency in the context of schedule management.

The research question, "Does the deployment of scheduling software on projects increase the efficiency of the project manager?" could therefore be answered deducing from the findings presented and the conclusions drawn from the analysis of responses aimed at satisfying the objectives. As indicated earlier in this study, efficiency in this context is considered from the schedule management perspective. It has been established that deploying various functions/features of scheduling software enhances the efforts of the project manager or scheduler to better manage large

numbers of activities in a less cumbersome way. It helps the project manager to save time which could have otherwise been spent on manually managing interdependencies between activities and/or multiple projects, so that (s)he can focus on other aspects of managing the project. Again, the project manager gains firm grips on schedule control as well as analysis of changes that have implications on timely completion with the automation of schedule management activities.

Beyond the deployment of scheduling software on personal computers, the future beckons with the advent of mobile technology, and we should be getting closer to a stage where project managers need not interfere with the assessment of physical progress of projects with their subjective minds but be able to quickly deploy technology which should be based on purely scientific reasoning. To push it further, mobile technology will make it easier and quicker to manipulate data for the appropriate responses when needed. This calls for adequate preparation of project managers and people who perform project management roles on projects in the area of scheduling software usage.

Scheduling software have the potential to create dashboards that prompt project managers or their teams on various parameters relating to physical progress reporting. With these timely prompts, certain situations can be (nearly) accurately predicted and arrested or mitigated earlier than they probably would, and some delays could be eliminated or minimized to enable project management teams deliver their targets within stipulated time.

5.3 Recommendations

It is evident from this study that quite a significant number of construction professionals have not accepted scheduling as an arm of project management that should be developed fully. By extension, it appears construction firms have not demonstrated enough interest in this area as well. Lack of adequate training of people who perform project management functions in the area of scheduling, the insignificant number of project management certification holders are some of factors based on which this conclusion could be drawn. To add on to this, only one firm had installed licensed scheduling software for the use of personnel responsible for schedule management.

Even though respondents admit the positive impact of scheduling software usage in their schedule management processes, there appears to be less emphasis on that knowledge area as respondents handle scheduling as part of their responsibilities. It is therefore recommended that:

1. Organizations that participate in the construction industry space as contractors, consultants or end-users should engage the services of personnel with the requisite schedule management skills
2. Organizations should make more efforts to train their employees who are put on roles that require them to manage project schedules.
3. Professionals who corroborate the essence of scheduling software in sequencing activities, estimating activity durations, developing schedules as well as controlling them, should consciously get involved in continuous professional development activities aimed at enhancing their skills especially in the area of scheduling software usage.

5.4 Limitations and Further Study

The study limited itself to construction projects. It did not consider other industries. It did not also consider the appropriateness of existing scheduling software to specific construction-related uses. Scheduling software are not developed specifically for construction managers. Hence, even the most proficient user would still have to adapt to suit his/her specific uses. Further studies in that area is recommended as well as an extension to other industries.

REFERENCES

Agyei W. 2015, 'Project Planning and Scheduling Using PERT and CPM Techniques with Linear Programming: Case Study', *International Journal of Scientific & Technology Research* Volume 4, Issue 08, pp 222. ISSN 2277-8616

Ahern, T., Leavy, B., Byrne, P.J., 2014. Complex Project Management as Complex Problem Solving: A Distributed Knowledge Management Perspective. *International Journal of Project Management,* 32, 1371-1381

Alias, Z., Zawawi, E.M.A., Yusof, K., Aris, N.M., 2014. Determining Critical Success Factors of Project Management Practice: A Conceptual Framework. *Procedia – Social and Behavioral Sciences,* 153, 61-69

Al-Kharashi A. and Skitmore M., "Causes of delays in Saudi Arabian public sector construction projects," *Construction Management and Economics*, vol.27,no.1,pp.3–23,2009.

AlNasseri, H.A., 2015. *Understanding Applications of Project Planning and Scheduling in Construction Projects.* Department of Construction Sciences, Lund University.

Altoryman, A., 2014. Identification and assessment of the risk factors affecting construction projects in the Gulf region: Kuwait and Bahrain. School of Mechanical, Aerospace and Civil Engineering, PhD thesis, University of Manchester, UK

Association for Project Management, 2015. *Planning, Scheduling, Monitoring and Control, The Practical Project Management of Time, Cost and Risk*. Ibis House, UK

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management,* 17(6), 337-342

Baldwin, A. & Bordoli, D., 2014. *Handbook for Construction Planning and Scheduling*, 1st ed. John Wiley & Sons, Chichester, UK

Blichfeldt, B. S., & Eskerod, P. (2008). Project portfolio management - There's more to it than what management enacts. *International Journal of Project Management*, 26(4), 357-365

Brandenberg, D., (n.d.). *Advantages & Disadvantages of Using a Project Scheduling Tool.* Retrieved from http://smallbusiness.chron.com/advantages-disadvantages-using-project-scheduling-tool-19278.html

Callahan, M T, Quackenbush, D G and Rawings J E., 1992. Construction Project Scheduling McGraw-Hill, UK

Carayamis E. G., Kwak H. Y., and Anbari F. T., 2005. *The Story of Managing Projects; an interdisciplinary approach,* CT, USA. P5

CIOB, 2002. *Code of Practice for Project Management for Construction and Development*. 3rd edition, Chartered Institute of Building, Blackwell, Oxford, UK.

Conlin, J. and Retik, A., 1997. The applicability of project management software and advanced IT techniques in construction delays mitigation. *International Journal of project management*, *15*(2), pp.107-120.

Edmonds, W. A., & Kennedy, T. D. (2012). *An Applied Reference Guide to Research Designs: Quantitative, Qualitative, and Mixed Methods*. Thousand Oaks, CA: Sage

Elonen, S., & Artto, K. A. (2003). Problems in managing internal development projects in multi-project environments. *International Journal of Project Management,* 21(6), 395-402.

Engwall, M., & Jerbrant, A. (2003). The resource allocation syndrome: the prime challenge of multi-project management? *International Journal of Project Management*, 21(6), 403-409

Faniran, O., Oluwoye, J., Lenard, D., 1998. Interactions between Construction Planning and Influence Factors. *Journal of Construction Engineering and Management*, 124, 245-256

González, P., González, V., Molenaar, K., Orozco, F., 2014. Analysis of Causes of Delay and Time Performance in Construction Projects. *Journal of Construction Engineering and Management,* 140, 1-9

Harris, F. and McCaffer, R. (2013) *Modern Construction Management*. 7th Edition, John Willey and Sons, 243-249.

Heagney, J., 2011. *Fundamentals of Project Management* 4th ed. American Management Association. New York

Hendrickson, C. and Au, T., 1989. *Project Management For Construction Prentice*-Hall, UK

Hooks, J., 2013 *Project Management Software Advantages and Disadvantages*. Retrieved from https://www.business2community.com/strategy/project-management-software-advantages-and-disadvantages-0412921

Hussein, B.A., Klakegg, O.J., 2014. *Measuring the Impact of Risk Factors Associated with Project Success Criteria in Early Phase.* Procedia- Social and Behavioral Sciences, 119, 711-718

Jun, L., Qiuzhen, W. and Qingguo, M., 2011. The effects of project uncertainty and risk management on IS development project performance: A vendor perspective. *International Journal of Project Management,* 29(7), pp.923-933.

Kanik, Y. 2005. Software Project Scheduling, Software Project Performance Measurement And Control. Thesis submitted to The Middle East Technical University

Kazaz et al. 2012, 'Causes of Delays in Construction Projects in Turkey', *Journal of Civil Engineering and Management,* Volume 18(3): 426–435 ISSN 1392-3730 Available at: <https://www.researchgate.net/ profile/ Serdar_ Ulubeyli/publication/241683720_Causes_of_Delays_in_Construction_Projects_in_Turkey/links/00b4953ce26f130fe5000000.pdf> Date accessed: 28 Apr. 2018.

Kerzner, H. 2009, *Project Management: A Systems Approach To Planning, Scheduling, And Controlling* -10th ed. New Jersey: John Wiley & Sons Inc.

Kumaraswamy, M.M., Chan, D.W., 1998. Contributors to construction delays. *Construction Management and Economics*, 16, 17-29

Marjolein C.J. & Ralph J.J.M. 2012. The Effects of Project Management Information Systems On Decision Making In A Multi Project Environment. *International Journal of Project Management* 30, 162–175

Memon, A., Abdul Rahman, I., Abdullah, M., & Abdul Aziz, A. (2011). Time Overrun in Construction Projects from the Perspective of Project Management Consultant (PMC). *Journal of Surveying, Construction And Property, 2*(1). Retrieved from https://ejournal.um.edu.my/index.php/JSCP/article/view/5653

Mubarak S. A., 2010. 2nd ed. *Construction Project Scheduling And Control*. John Wiley & Sons, Inc., Hoboken, New Jersey

Nair TRG, Suma V, Shashi Kumar NR (2011) – "*An Analytical Approach for Project Managers in Effective Defect Management in Software Process",* The 5th Malaysian Software Engineering Conference, Malaysia, IEEE published

Naoum, S.G. (1998). *Dissertation research and writing for construction students*. Oxford: Butterworth-Heinemann

Neuman, W. L. (2000). *Social research methods: Qualitative and quantitative approaches*. Boston: Allyn and Bacon.

PC Plus: 1993 *Software Guide* Future Publishing, London,

Pierce, D.R., 2013. *Project scheduling and management for construction*, Fourth ed. John Wiley & Sons, New Jersey.

Project Management Institute, 2011. *Practice Standard for Scheduling*, 2nd edition, Project Management Institute, Philadelphia, Pa, USA

Project Management Institute, 2017. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 6th edition, Project Management Institute, Philadelphia, Pa, USA,.

Schwalbe, K. (2013). *Information Technology Project Management*. United States: Cengage Learning.

Standish Group International, Inc, 2009. CHAOS Summary 2009. report. from:http://www.standishgroup.com. retrieved May 20, 2010

Wallace, L., Keil, M., Rai, A., 2004. How software project risk affects project performance: an investigation of the dimensions of risk and exploratory model. *Decision Sciences* 35 (2), 289–321

Wallace, L., Keil, M., Rai, A., 2004. How software project risk affects project performance: an investigation of the dimensions of risk and exploratory model. *Decision Sciences* 35 (2), 289–321

Walliman N., 2011. *Research Methods: the basics*. Routledge, USA

Whity S. J., and Maylor H., 2008. And Then Came Complex Project Management. *International Journal of Project Management*, Volume 27, Number 3, Pages 304-310

Yin, R. K., (1994). *Case Study Research Design and Methods: Applied Social Research and Methods Series.* 2nd ed. Thousand Oaks, CA: Sage Publications Inc.

Zmud, R.Z., 1980. Management of large software development efforts. *MIS Quarterly* 45–55 (June)

APPENDIX

DATA COLLECTION INSTRUMENT

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF ART AND BUILT ENVIRONMENT

DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

Dear Sir/Madam,

QUESTIONNAIRE SURVEY: THIS STUDY AIMS AT REVIEWING THE EXTENT OF SCHEDULING SOFTWARE USAGE ON PROJECTS

I am currently undertaking a study aimed at exploring the effect of scheduling software usage on project schedule management in some selected projects in Accra.

In addressing the stated aim, I am conducting a questionnaire survey to solicit information from players in the construction industry. This study will help evaluate the level of efficiency the deployment of scheduling software on projects achieves

This study is solely for academic purposes and your responses will be treated as STRICTLY CONFIDENTIAL. Respondents will be provided with the findings of the study upon request.

I would like to thank you for accepting to assist and cooperate towards this study.

Yours Sincerely,

Nehemiah Kpabu Paul **(MSc Student)** Dr. Emmanuel Adinyira **(Project Supervisor)**

Mobile: 0245779763 Department of Construction Management &Technology

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SECTION A: DEMOGRAPHIC INFORMATION

(Please choose your option by clicking its corresponding box)

1. How long have you been working in the construction industry?

☐ Less than 5years ☐ 5 – 10years ☐ 11 – 15 years ☐ More than 15years

2. How long have you been working in your current company?

☐ Less than 5years ☐ 5 – 10years ☐ 11 – 15 years ☐ More than 15years

3. What is your professional inclination? (You can select more than one)

☐ Architect ☐ Quantity Surveyor ☐ Engineer ☐ Project Manager ☐ Other

4. What is your highest level of education?

☐ HND ☐ Bachelor's Degree ☐ Master's Degree ☐ PhD

5. In the construction industry, which space does your company operate?

☐ Contractors ☐ Consultants ☐ End-User (Client) ☐

SECTION B:

ASSESSING THE LEVEL OF SCHEDULING SOFTWARE USAGE ON YOUR PROJECTS.

The questions in this section seek to find out the level of scheduling software usage by yourself and your organisation. Kindly provide answers to the following questions by ticking the applicable boxes (☒) and by writing in the spaces provided where necessary:

1. Are you a certified Project Manager?

☐ Yes ☐ No

2. If yes, which Project Management Certification do you hold?

☐ PMP ☐ CAPM ☐ CPMP ☐ RegPM ☐ ChPP ☐ Prince2 ☐ Other

3. If No, do you perform any project management roles in your organisation?

☐ Yes ☐ No

4. Has your current company procured scheduling software for its operations?

☐ Yes ☐ No If Yes, move on to Questions 7, then 9

5. Have you installed any scheduling software on your personal computer for your use?

☐ Yes ☐ No

6. How many of your colleagues have also installed same?

☐ Less than 2 ☐ 3 – 5 ☐ 6-10 ☐ more than 10

7. Are you able to use the scheduling software in managing projects?

☐ Yes ☐ No

8. Do you have exclusive rights to its usage?

☐ Yes ☐ No

9. How long have you been using scheduling software?

☐ Less than 5years ☐ 5 – 10years ☐ 11 – 15 years ☐ More than 15years

10. How would you rate your level of proficiency in the usage of the scheduling software? On a scale of 1-5

1=Not Proficient 2=Below Average 3=Moderately proficient 4= Proficient 5= Very Proficient

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

11. Apart from you, please indicate the number of employees in your firm who are able to use the scheduling software?

☐ Less than 2 ☐ 3 – 5 ☐ 6-10 ☐ more than 10

(Please answer 12-20 whether the software was procured by your organisation or you installed on your own)

12. Have you received training on its usage by your current company?

☐ Yes ☐ No

13. Have you received previous training elsewhere on the usage of the scheduling software?

☐ Yes ☐ No

14. Does your company have exclusive rights to the usage of the procured software? (Skip this if your company hasn't procured one)

☐ Yes ☐ No

15. How much did the procured software cost? (Please answer if you or your company has exclusive rights to usage)

☐ Less than $500 ☐ $500 – $1,000 ☐ $1,000- $5,000 ☐ More than $5000 ☐ No idea

16. Do you find it expensive?

☐ Yes ☐ No

17. Do you play any role in the maintenance of the software?

☐ Yes ☐ No

18. Do you undertake any of the following activities periodically? (You may select more than one option)?

☐ Running antivirus and spyware scans. ☐ Cleaning up your Operating System

☐ Adding or deleting users from a system, or modifying user rights and properties

☐ Backing up stored files ☐ Documenting trends and patterns in the use of the application

☐ Cleaning dust from your computer ☐ Cleaning up your cabling

19. Have you received any training in maintaining the software?

☐ Yes ☐ No

20. Have you received any training on the usage of any other scheduling software apart from the one being used by your current company?

☐ Yes ☐ No

21. Apart from the scheduling software being used by your company or yourself, which others are you aware of? (You may select more than one)

☐ Artemis ☐ Finest Hour ☐ Maximo ☐ MicroPlanner ☐ Oracle P6 ☐ MS Office Project ☐ Open Plan Professional ☐ PERTmaster

☐ Parade ☐ Primavera Project Planner (P3) ☐ Project Two ☐ PS-Next

☐ Risk ☐ RiskyProject ☐ SureTrak ☐ @Task.

		1	2	3	4
	Kindly select from options 1 to 4 for Questions 18-23 1=strongly disagree 2=disagree 3=agree 4=strongly agree				
22	The deployment of the scheduling software enables me to better sequence activities	☐	☐	☐	☐
23	The deployment of the scheduling software enables me to better estimate activity durations	☐	☐	☐	☐
24	The deployment of the scheduling software enables me to accurately develop schedules	☐	☐	☐	☐
25	The deployment of the scheduling software enables me to better control schedules	☐	☐	☐	☐
26	Using scheduling software I work faster at generating schedules	☐	☐	☐	☐
27	The usage of scheduling software on simple projects make them look complicated	☐	☐	☐	☐

28. Have you noticed any security flaws in the scheduling software your company uses?

☐ Yes ☐ No

26. Would you recommend the scheduling software to another company?

☐ Yes ☐ No

27		1	2	3	4	5
	INDICATE HOW CONVERSANT YOU ARE WITH THE FOLLOWING USES & FEATURES SCHEDULING SOFTWARE 1= Not Conversant 2=Below Average 3= Moderately Conversant 4=Conversant 5=Very Conversant					
i.	Cost Planning	☐	☐	☐	☐	☐
ii.	Tracking Progress	☐	☐	☐	☐	☐
iii.	Earned Value Analysis	☐	☐	☐	☐	☐
iv.	Resource Allocation	☐	☐	☐	☐	☐
v.	Critical Path Analysis	☐	☐	☐	☐	☐
vi.	Cashflow forecasting	☐	☐	☐	☐	☐
vii.	Cost and Time Change Management	☐	☐	☐	☐	☐
viii.	Data Integration with other software packages	☐	☐	☐	☐	☐
ix.	Macros	☐	☐	☐	☐	☐
x.	Networking mode	☐	☐	☐	☐	☐
xi.	What-If-Analysis	☐	☐	☐	☐	☐
xii.	Multi-Project Analysis	☐	☐	☐	☐	☐
xiii.	Sorting	☐	☐	☐	☐	☐