UNIVERSITY OF NAIROBI

THE ROLE OF PROGRAM OF WORKS IN TIMELY COMPLETION OF CONSTRUCTION PROJECTS IN KENYA

(CASE OF PUBLIC WORKS BUILDING PROJECTS IN NAIROBI)

MWILU STEPHEN MUNYAO
B50/69381/2011

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AWARD OF A DEGREE OF MASTERS OF ARTS IN CONSTRUCTION MANAGEMENT, DEPARTMENT OF REAL ESTATES AND CONSTRUCTION MANAGEMENT, SCHOOL OF BUILT ENVIRONMENT.

AUGUST 2017

DECLARATION

This research project is my original work and has not been presented for a degree in any other university. No part of this proposal may be reproduced without the prior written permission of the author and/or the University of Nairobi.

Name: **MWILU STEPHEN MUNYAO**

REG NO: B50/69381/2011

Signature…….Date…….

Supervisor's Declaration.

This research project has been submitted for examination with my approval as a University Supervisor.

Name of Supervisor:

PROF. HEZEKIAH GICHUNGE

Signature……...Date……...

DEDICATION

This thesis is dedicated to all the members of my family – wife, Lucy and children: Ian, Brian and Maya - who have been the encouragement for me to reach highest heights in my academic endeavour.

ACKNOWLEDGEMENT

This thesis has been accomplished because God enabled me to undertake it. Many a time I felt overwhelmed but God renewed my strength and I soldiered on. I am also indebted to my supervisor, Prof. Hezekiah Gichuge, who invested hours in reading drafts of the thesis, critiquing the work, offering suggestions and pushing me at every turn to make the final product better.

Much appreciation is due to my able research assistants – Kennedy and Peter - who greatly assisted in collecting data, processing the data, and editing the research report. I greatly acknowledge your dedication, team spirit and carefulness.

My gratitude also goes to the University of Nairobi for granting me the opportunity to study in so noble an institution, and particularly to the School of the Built Environment, for providing the learning environment in which this research work was delivered.

Finally, let me point out that should there be any error in this work, it does not in any way reflect the contribution of any of the aforementioned; it is solely attributed to me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

CIOB	Chartered Institute of Building
CPM	Critical Path Method
DD	Delay and Disruptions
EN	Excusable non-compensable
GDP	Gross Domestic Product
NN	Nonexcusable - noncompensable
PERT	Programme Evaluation Review Technique
SPSS	Statistical Package for Social Sciences
NCA	National Construction Authority
UK	United Kingdom
USA	United States of America

ABSTRACT

In the construction industry today, delays and disruptions are among the challenges faced in the course of executing works. In Kenya, construction project delay is a widespread phenomenon and reflects poor project time management practices. The widespread delays and disruptions in government sponsored projects is an issue that frustrates development in the country. The purpose of this study was to investigate the influence of the program of works on contractor performance in project delivery in the construction industry of Kenya, for the purpose of enhancing efficiency in the project delivery, by minimizing delays and disruptions in the construction industry. The study investigated the importance of the program of works in the construction industry and established factors to consider when preparing a program of works. It also investigated the various shortcomings or deficiencies in the program of works and established the cause of these shortcomings.

The study adopted a survey research design and employed two research instruments: document analysis guide and an in-depth interview schedule. The study laid focus on housing construction projects undertaken by the government of Kenya, through the relevant ministry, and whose supervision has been carried out from the Ministry headquarters in Nairobi. The interviews with ministry officials were used to gather data from project managers, contractors and other players in public works. A sample of 15 projects was investigated, whereby interview data on each project was given by one respondent and document analysis used to gather the relevant data on the project from the government records. The study found that program of works is considered an important tool for managing projects; it is a very essential variable considered for meeting construction timelines. Therefore poor preparation and/or implementation of the program of works normally cause deficiency in the execution of a project. For example, failure to update the program of work renders the program rather weak for its purpose. Such failure may arise from the cost – to the contractor - of the preparation of the program, or lack of the contractor's understanding of scheduling techniques.

In line with these findings and conclusions, the researcher recommends improvement in the preparation and implementation of the program of works as a tool for managing projects by: (i) enhancing contractors' and consultants' understanding of scheduling techniques;

and (ii) introducing a requirement for timely updating of program of works, in the construction.

CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

Construction industry is one of the key contributors to most economies in the world. According to Hillebrandt (2000), the importance of the industry to the economy is considerable, and can be measured by the industry's (i) contribution to the Gross Domestic Product (GDP); (ii) contribution to investment; and (iii) volume of labour employed. She also points out that the construction industry contributes between 3% and 10% of the GDP internationally. Although this contribution is typically lower in developing countries – as shown in the Republic of Kenya (2005), for example – and higher in developed countries, it highlights the need for efficiency in the organizational performance of the industry as a whole and the delivery of individual projects in it.

Timely completion of the construction project is a major aim of every project team, and ways to achieve this aim are clearly amplified in project management literature. For example, the *Guide to the Project Management Body of Knowledge* (PMI 1996: 59) amplifies five processes required to ensure timely completion of a project, namely: (i) activity definition; (ii) activity sequencing; (iii) activity duration estimating; (iv) schedule development; and (v) schedule control. This implies that an expert scheduler and/or construction manager is actually well guided on exactly what to do to achieve this grand aim. This notwithstanding, timely completion of construction projects remains an elusive goal in the construction industry today. There appears to be underlying challenges with the program of works – i.e. schedule preparation or usage - which have not yet been addressed in construction research.

The problem of excessive delays in the construction projects is a global phenomenon, which has persisted over a long period of time. Many researchers – for example Baldwin *et al* (1971), Bromilow (1969), Gichuge (2000), Gwaya (2015) and Talukhaba (1999) - have investigated the phenomenon of time overruns in Kenya and beyond. In these studies, the reference point in the measurement of the time overrun is the original project schedule and/or contract period whose accuracies have been questioned (see for example, Kivaa

2000). An inaccurate reference may not give a true picture of the actual extent of delay. There is therefore need for further scrutiny into the preparation and usage of the program of works in construction projects.

Excessive project delays and program disruptions continue to pose a great challenge for project employers and contractors at all levels in the construction industry. According to Gichuge (2000) and Talukhaba (1999), the percentage of client-related causes of project delays is almost equal to the percentage of the contractor-related causes of the same. This implies that addressing the delays/disruptions problem comprehensively requires investigation of the roles of both the client and the contractor in construction planning and control.

1.2. Statement of the Problem

The problem investigated in this study is that the preparation and usage of the program of works remains poor in the construction industry of Kenya. In this study the terms "program of works" and "project schedule" are used interchangeably because while "project schedule" is the more accurate term technically, "program of works" is the term used most commonly in the preliminaries section of the bills of quantities today. According to Hendrickson (1989), many field supervisors disdain from and dislike formal scheduling procedures. In particular, the critical path method of scheduling is often regarded in the field as irrelevant to actual operations and a time consuming distraction. The result is "seat-of-the-pants" scheduling that can be good or that can result in grossly inefficient schedules and poor productivity.

In Kenya, local contractors often fail to come up with a practical and workable work 'program' at the initial planning stage, and this has been considered a reason for time overruns in most road construction projects in the country (Muoria 2012). This failure is interrelated with lack of systematic site management and inadequate contractor's experience in handling the projects. The consultant only checks and reviews the work program submitted by the contractors based on experience and intuitive judgment.

Therefore, both the *standard* of the program of works required and the *usage* of the program in the project control are rather unrealistic for effective project delivery.

The consequences of this practice may be outlined as follows: -

(i) *Poor project execution*: Only a project that is well planned can be well executed (Sambasivan and Soon, 2006). Improper planning at the initial stages of a project manifests throughout the project and causes delays at various stages. Many construction projects experience unexpected delays, disruptions or changes to the planned activities, which can result in additional costs being incurred.

(ii) *Inaccurate assessment of contractor performance:* An unrealistic work program and/or contract period gives a wrong impression of the real time overrun in a project (Kivaa 2000, Muoria 2012). Therefore the level of time overruns (percentages, frequencies, severities, etc) highlighted in many previous studies in this area may actually be erroneous.

A realistic program of works - prepared from the very onset of a project and applied in the project control appropriately - should enhance the contractor's efficiency in the project delivery. According to Klein (2002) disputes and losses in the construction industry due to delays and disruptions could significantly be reduced by the introduction of a transparent and unified approach to the understanding of programmed works (both permanent and temporary) their expression in records, and identifying the consequences of delay and disruption. The preparation and contents of the program are considered serious aspects that need to be considered in the construction industry. Additionally, Klein (2002) advices for the need of the program of works to contain all the relevant activities - including design, manufacturing, procurement and on-site construction - and to ensure that it identifies all the necessary information. In a bid to address this matter, progressive construction firms use formal scheduling procedures whenever the complexity of work tasks is high and the coordination of different workers is required. This should be the way to go in the mainstream construction industry of Kenya.

1.3. Objectives of the Study

1.3.1. General Objective

The aim of this study is to investigate the role of the program of works on contractor performance in project delivery in the construction industry of Kenya, for the purpose of enhancing efficiency in the project delivery, by minimizing delays and disruptions in the construction industry.

1.3.2. Specific Objectives

The specific objectives of the study are:-

1. To establish the importance to which project participants attach to the program of works in a construction project;
2. To describe the factors normally considered in the preparation of the project schedule;
3. To highlight the deficiencies found in the programs of works, which are considered to have lead to delays and disruptions of the works in the construction projects;
4. To explain the underlying causes of the deficiencies in the program of works in the construction industry.

These objectives are achieved by surveying public construction projects in Kenya.

1.4 Research Questions

1. Is there a program of works in the project?
2. What is the importance of the program of works to the project team?
3. How frequently is the program updated?
4. Which factors are considered in the preparation of a program of works?
5. Which deficiencies in the program of works and which led to delay and disruptions of works have you ever come across?
6. What causes deficiencies in the programs of work?
7. How can a sustainable program of works be formulated for a construction site?

1.5. Significance of the Study

Each of the numerous participants in the process of planning, designing, financing, constructing and operating physical facilities has a different perspective on project management for construction. Specialized knowledge can be very beneficial, particularly in large and complicated projects, since experts in various specialties can provide valuable services. This study will provide valuable insights for both contractors and their clients on issues pertaining to programs of works and the best practice for their usage. To the scholars, the study will provide a rich data base of information that can be used a source of future reference.

An innovative framework for minimizing delays and disruptions in public works will be developed and will comprise of good practice recommendations on preparation and enhancement of programs of works. The framework will serve as a tool for assisting all players in the construction industry in better understanding the importance and role of the program of works in reducing delays and disruptions in construction projects.

1.6. Scope of the Study

This study was limited to housing projects, which included flats, maissonettes and bungalows that were being undertaken by the Ministry of Public Works which have now been taken over by the Ministry of Lands, Housing and Urban Development, for the last five years and were supervised from the Ministry Headquarters in Nairobi.

1.7. Limitations of the Study

This study was set to face several limitations which include identification of players in completed public construction that were carried out within the period under investigation. All efforts was undertaken to ensure that as many past and current players participate in this study. Another limitation that this study envisages was that of retrieving program schedules of various projects due to the time span. In order to meet this limitation, all efforts was undertaken to retrieve necessary data that may prove of value to this study.

1.8. Operational Definition of Terms

Claim Any application by the contractor - whether for an extension of time, payment, or otherwise - which arises other than under the ordinary contract provisions for payment on account of the work done in the contract.

Critical delay Any significant hold-down to completion of the project on time within the required work plan.

Delay Any occurrences or events that extend the duration or delay the start or finish of any of the activities of a project.

Disruption These are interruptions or disturbances to the regular progress of the works onsite. They may occur due to poor planning of the project or poor overall management in the project.

Non-Critical Delay Any delay that affects progress but not overall completion.

Project Managers The professional officers in the government ministry in-charge of public works who are specifically assigned to each project to give overall guidance in the implementation of the building project.

Program of Works The Project Schedule. As stated before, in this study the terms "program of works" and "project schedule" are used interchangeably because while "project schedule" is the more accurate term technically, "program of works" is the term used most commonly in the preliminaries section of the bills of quantities today.

Public Works A broad category of infrastructure projects, financed and constructed by the government.

Updating Reviewing periodically the plan and progress of the works on site.

1.9. Outline of the Study

Chapter I is the introduction to the study, and it presents the research problem and its setting. The problem statement is given and the objectives of the study highlighted.

Chapter II is on the literature reviewed in the field of project planning and control, bringing out the theoretical background of the study. The theory and practice of project planning and control are amplified, and the place of project scheduling in scientific management is highlighted. Finally, common challenges of schedule preparation and usage encountered in practice are presented.

Chapter III is methodology used in the research. The methods of data collection and analysis adopted in the study are presented.

Chapter IV presents the data analysis and results. It describes the data collected, and presents the data analysis results in respect of each of the objectives of the study.

Chapter V presents the study conclusions and gives recommendations based on the research findings. Finally, areas for further research are highlighted.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The literature review shall involve the systematic identification, location and analysis of documents containing information related to the research objectives as outlined by Mugenda and Mugenda (2003). In line with this, this chapter comprises the literature review of the study and takes a look at the major types of construction. Delays and disruptions in the construction industry are also discussed. The chapter offers a critical analysis on the deficiencies of program of works and factors that lead to these deficiencies. All this is undertaken with an intention of developing an appropriate framework in the construction industry that pertains to the efficiency of programs of works in assisting contractors and clients meet laid out project timelines.

2.2. Contractor Performance

Measuring performance is a complex problem (Ofori and Chan, 2001). This is because every contractor is unique in terms of the manner in which he follows design specifications, method of delivery, administration, and composition of team members. Evaluation of performance has been a challenge for the construction industry for decades. According to Neely (2005), performance measurement is the set of metrics used to quantify both the efficiency and effectiveness of actions. In the manufacturing and construction industries, performance measurement is used as a systematic way of judging project performance by evaluating the inputs, outputs and the final project outcomes. However, very few companies systematically measure their performance in a holistic way. Moreover, the existing systems tend to focus more on product and less on process and design. This can lead to the sub-optimal quality of the performance measurement system, the misjudging or relative performance, and to complacency and the denying of appropriate rewards to the deserving.

Performance measurement is the regular collecting and reporting of information about the inputs, efficiency and effectiveness of construction projects. It is used to judge project

performances, both in terms of the financial and non-financial aspects and to compare and contrast the performance with others, in order to improve programme efficiency and effectiveness in their organizations (Takim *et al.,* 2003). Moreover, measurements are needed to track, forecast, and ultimately control those variables that are important to the success of a project, and this has been agreed on by many researchers and practitioners (Sinclair and Zairi, 1995; Mbugua *et al.*, 1999 & Love *et al.*, 2000). More specifically, Kelada (1999) suggests that the performance measurements used apply not only to product or service quality and to business performance, but should also be extended to quality management, customer satisfaction, needs, wants and expectations.

Performance measurement provides necessary information for process control, and makes it possible to establish challenging and feasible goals. It is also necessary to support the implementation of business strategies. Despite the importance of performance measurement, it has not been widely implemented in construction companies and information on the performance of the construction industry as a whole is also scarce (Dayana *et al.,* 2013). However contractor performance is critical to the success of any construction project which is the determinant of cost, time and quality standard because the contractor convert the design into practical reality (Xiao and Proverbs, 2003). Untimely completion of construction projects has been found to be a major setback in the construction industries in Kenya. Therefore an improved contractor performance can lead to increased client satisfaction, improvement in reputation and competitiveness in the market (Ogunsemi & Jagboro, 2006).

Renewal of registration by contractors is undertaken annually and contractors whose performance is satisfactory have their grades upgraded appropriately. Current construction projects are complex and a lot of efforts and support of the design and construction profession is required (Ogunsemi & Jagboro, 2006). Accordingly, a realistic time for execution of the project should reduce the possibility of disputes. According to Xiao and Proverbs (2003), this performance is also reflected by the contractor's ability to organise and control his site operations, to optimally allocate resources and to manage the flow of

information to and from the design team and among contractors. Therefore, the correct choice of a contractor has a significant impact on the success or failure of a project.

Attempting to predict contractor performance with regard to a forthcoming project requires appraisal of current workload and residual resource capacities as well as investigation of performance on recent project (Chan & Kumaraswamy 1996). Every construction project faces adversity and uncertainty and an inappropriate contractor increases the chances of delays, cost over-runs, substandard work, disputes or bankruptcy (Elinwa and Joshua, 2001). The performance of a project will definitely correlate with the performance of a contractor. The evaluation of performance has been a challenge for the construction industry for decades. Several models and procedures have been proposed for the evaluation and measurement of project performance. However, most of these procedures limit their analysis to selected measures such as cost, schedule, or labour productivity. In order to raise the level of competitiveness, contractors need to increase the use of performance assessment tools as a means of supporting performance improvement programmes.

Contract performance is defined to embrace construction cost, construction time, construction quality, and sustainable development, the philosophy being that the achievement of one aspect of performance should not be at the expense of another (Hong and Proverbs, 2003). From the standpoint of Dayana et al (2003), the major indication of a contractor's performance is the client's satisfaction. Poor contractor performance as characterised by poor work quality and low productivity is common in the industry. Furthermore, other problems associated with poor performance are cost over-runs, late completion, unacceptably high accident rate, insensitivity to environment consideration, poor work practices and adversarial relationships (Allens, 1994, Henry, 1994, Lobelo, 1996).

2.3. Major Types of Constructions

The construction industry is a large, dynamic, and complex industry sector that plays an important role in a country's' economy. Construction work can involve building of new structures, which may include activities involved with subdividing land for sale as building sites or preparation of sites for new construction. It also includes renovations of existing structures. This involves additions, alterations, or maintenance and repair of existing buildings or engineering projects such as highways or utility systems (Hillebrandt 2000).

According to Hendrickson (1989) and (Hillebrandt 2000), there are four major types of construction which are as highlighted as follows: -

2.3.1. Residential Housing Construction

Residential housing construction includes single-family houses, multi-family dwellings, and high-rise apartments. During the development and construction of such projects, the developers or sponsors who are familiar with the construction industry usually serve as surrogate owners and take charge, making necessary contractual agreements for design and construction, and arranging the financing and sale of the completed structures. Residential housing designs are usually undertaken by architects and engineers, and the construction executed by builders who hire sub-contractors for the structural, mechanical, electrical and other works. An exception to this pattern is for single-family houses which may be designed by the builders as well.

2.3.2. Institutional and Commercial Building Construction

Institutional and commercial building construction encompasses a great variety of project types and sizes, such as schools and universities, medical clinics and hospitals, recreational facilities and sports stadiums, retail chain stores and large shopping centers, warehouses and light manufacturing plants, and skyscrapers for offices and hotels. The owners of such buildings may or may not be familiar with construction industry practices, but they usually are able to select competent professional consultants and arrange the financing of the ongoing construction facilities themselves. Architects and engineers are often engaged for designing a specific type of building, while the builders or general contractors undertaking

such projects may also be specialized in only that type of building. Because of the high costs and greater sophistication of institutional and commercial buildings in comparison with residential housing, this market segment is shared by fewer competitors.

2.3.3. Specialized Industrial Construction

Specialized industrial construction usually involves very large scale projects with a high degree of technological complexity, such as oil refineries, steel mills, chemical processing plants and coal-fired or nuclear power plants. The owners usually are deeply involved in the development of a project, and prefer to work with designers-builders such that the total time for the completion of the project can be shortened. They also want to pick a team of designers and builders with whom the owner has developed good working relations over the years. Although the initiation of such projects is also affected by the state of the economy, long range demand forecasting is the most important factor since such projects is capital intensive and require considerable amount of planning and construction time. The governmental regulation profoundly influences decisions on these ongoing projects.

2.3.4. Infrastructure and Heavy Construction

Infrastructure and heavy construction include projects such as highways, mass transit systems, tunnels, bridges, pipelines, drainage systems and sewage treatment plants. Most of these projects are publicly owned and therefore financed either through bonds or taxes. This category of construction is characterized by a high degree of mechanization, which has gradually replaced some labour intensive operations. Engineers and builders engaged in infrastructure construction are usually highly specialized since each segment of the market requires different types of skills. However, demands for different segments of infrastructure and heavy construction may shift with saturation in some segments. For all the above highlighted categories of construction, it is evident that the manner in which the different components of time, financial resources and project deliverables fit together is of paramount significance in determining the project success. The program of works presents the framework for linking these components. The following section highlights some key issues surrounding the manner of program of works.

2.4. The Program of Works

The program of works is an integral part of project documentation.

2.4.1. Types of Program of Works

There are two main types of program of works: *resource oriented* and *time oriented* scheduling techniques. For resource oriented scheduling, the focus is on using and scheduling particular resources in an effective fashion. For example, the project manager's main concern on a high-rise building site might be to insure that cranes are used effectively for moving materials; without effective scheduling in this case, delivery trucks might queue on the ground and workers wait for deliveries on upper floors. For time oriented scheduling, the emphasis is on determining the completion time of the project given the necessary precedence relationships among activities. Hybrid techniques for resource leveling or resource constrained scheduling in the presence of precedence relationships also exist. Most scheduling software is time-oriented, although virtually all the programs have the capability to introduce resource constraints (Hendrickson, 1989).

2.4.2. Role and Importance of the Program of Works

Most construction contracts require that the contractor provides a program of works at the commencement of a project in order to show the sequence and timing of the construction activities. Not only do program of works serve as tools for managing projects, they are also valuable sources of information for identifying and modeling delays and their effect on progress. The program also indicates the intent and also offer useful historical records, which enable the determination of the effects of delay events and calculation of damages (Braimah, 2008). The program of works submitted by the contractor is the initial as-planned program that reflects the intended plan for executing the project. Its importance in delay and disruption analysis lies in its ability to demonstrate the period of time within which the contractor would have completed the project absent any delays. It allows the performance of time related obligations to be monitored with the functions of the program of works depending on the terms of the contract.

2.5. Deficiencies in Program of Works

According to Bramble and Callahan (2000) for the program of work to be an efficient tool for managing projects they must be free of any deficiencies. Despite this notion, there have been observable deficiencies in the programs of works. Scott (1997) found that most programs of work are poorly produced and lack appropriate activity details. Keane (1994) also noted that the preparation, format and logical basis of most programs of works are usually unsatisfactory. In addition, contractors are reluctant to provide details of envisaged resources in their programs thus making it difficult to assess the impact of delays on usage of resources and their productivities in the event of delays (Yogeswaran *et al*, 1998). For these reasons, the programs of works do not have the necessary links amongst the activities on site, are not resource-driven, and are not prepared to reflect what will actually happen on site; they are just designed for tender purposes.

Whilst there are obvious benefits to proper scheduling of works Braimah (2008) is concerned that many contractors do not provide employers with a proper programme and then manage it appropriately. Many reasons have been identified for this. Jaafari (1984) observed that CPM scheduling was not performing well because of: lack of experience and willingness on the part of contractors, difficulty in controlling performance against the plan due to general variations, the use of multiple contracts and lack of detailed design before project commences. Similar findings were identified by Nahapiet and Nahapiet (1985) in their research into management of construction projects in the UK and US. They observed marked reluctance by contractors to update programs even when the nature and number of activities had altered over time. The reasons given for this reluctance ranged from the amount of work reprogramming would entail, to the almost certain knowledge that as soon as any revision had been submitted, further changes would invalidate it. In addition, Mace (1990) in a review of programming practice identified a number of problems: treating programs as a recording mechanism instead of as a forward planning; lack of adequate information on various procurement times of some activities; and the tendency of relying entirely on computer with little consideration of the users of the plans on error checking.

These deficiencies can lead to difficulties and disputes in resolving claims because, in the absence of properly prepared and timely updated CPM program, it becomes difficult to determine whether delayed completion is indeed due to the specific types of delays complained of, i.e., causal connection between breach and damage is not readily apparent. The following literature discusses in depth some of the shortcomings associated with the program of works.

2.5.1. Poor Preparation

According to Zafar and Rasmussen (2001) shortcomings in baseline programs that often make them invalid or unreliable tools for this purpose include the following.

a) A program prepared in a format other than CPM which is the format that is highly recognized as a tool for proving delay because it allows the determination of the critical path and shows the interrelationships among multiple causes of delay.
b) Incomplete program: That is failing to include all the work that must be undertaken. This makes it difficult to evaluate how all activities and their delays interact to affect project completion.
c) Insufficient details provided for the program activities: This makes it difficult to measure progress and the effect of delays adequately. For instance, consider an employer ordering a variation in a building project that affected an activity on the critical path described as “construct first floor slab”. If this variation actually affected the scope of some of the specific work tasks within this activity, then the actual delay incurred as a result of the variation cannot be accurately determined.
d) Unreasonable logic or relationships between activities: Such relationships do not accurately represent the contractor’s intended sequence of work and thus would result in erroneous delay analysis results.
e) Insufficient provisions for constraints likely to be encountered: Examples of such constraints include local weather conditions; statutory requirements and restrictions, contractual stipulations on the order in which the works are to be completed; time required for employer or other agency for approvals, inspections and information and availability of equipment and material.

f) Unrealistic planned resource allocations. This results in incorrect duration and cost allocation of activities making the baseline programme unreliable.
g) Unrealistic durations of major activities: The effect of this is the creation of unreasonable floats and incorrect project completion date in the baseline programme.

2.5.2. Failure to update Programs of Works

Updating of the programs of works is an essential aspect of project management. This is necessitated by the fact that the uncertain conditions in which construction projects operate inevitably cause plans and estimates to change (Laufer *et al.,* 1994). There may also be a need to evaluate work procedures, performances, delays and their associated causes and as a result of the inevitable changes in construction projects, failure to update the program would result in lack of important information such as:

- changes in critical path; actual start and finish dates and percent complete for each activity;
- milestone status and potential problem areas;
- Logic changes from previous updates.

2.5.3. Inadequately updated programs

An updated program that does not adequately reflect the contractor's as-built progress as the project unfolds would not be able to accurately predict project delays and their impacts. There are different approaches to updating which can affect the adequacy of updated programs. One approach is updating the program as and when the scheduler deems it necessary. For instance, updating the program when the project falls behind schedule or when unexpected changes in the program occur as required by some contract documents. Other important factors influencing the frequency of updating include occurrence of specific control events, the degree of uncertainty, the magnitude of the project, the time of completion and the troubles encountered (Kursave, 2003).

Another approach involves pre-determined periodic updates. This approach has the tendency of giving more accurate picture of how the work progressed than in the first approach. This is because in this first approach for instance, the scheduler may not be fully

aware of project slippage so that, by the time he/she agrees that an update is needed, the project might have slipped considerably and contemporaneous information for updating might not be readily available.

Other factors affecting the adequacy of updated programs are the degree of detail of the updating. As a minimum in each updating process, the following have to be identified: actual start dates, actual finish dates, percent complete and remaining durations per schedule activity (Kursave, 2003). The accuracy and timing of these data are also very important in the production of proper updated programs.

2.6. Causes of Deficiencies in the Program of Works

The production of a reliable baseline programme involves the collation of information from various sources. *A guide to good programming practice*, produced by the UK's Chartered Institute of Building (CIOB, 1991) grouped these sources of information into a number of forms and which included:

a) Project information (contract, design, site, specialist);
b) Production information (staff experience, previous jobs records, etc);
c) Reference information (industry data, papers, periodicals);
d) Factual information (weather records, dimensions of equipment, etc) and
e) The planning brief

Specific skills are required in order to gather this information and translate it analytically into a reasonable baseline program and other planning outputs such as method statements, cost and cash flow forecasts, manpower requirements, material requirements, project organization and site set up and layout.

A number of issues tend to impact on the planning and programming process, which can cause deficiencies in the program produced and their subsequent updates. A review of research-based papers and published commentaries by practitioners identified the following as the possible causes of deficiencies in programs of works and its formulation practice:

2.6.1. Inadequate Planning Expertise

The achievement of satisfactory programs of works calls on planners to have high competence and experience. However, Kelsey et al. (2001) claims that there had been the emergence of planners who had little site experience. On the other hand Street (2000) in a review of pitfalls of CPM scheduling on construction projects, noted that most contractors do not have in-house CPM expertise a situation that is likely to result in poorly developed and poorly maintained schedules.

2.6.2. Poor enforcement of the Program of Works

In the construction industry, most contractors view program of works as nothing more than a requirement of the contract and do not take it seriously enough to properly develop and maintain them. Esthete and Langford, (1987) note that a clause in contract documents does not in itself encourage the use of CPM-based program, rather top management support is vital for them to be used. Poor enforcement of planning obligations will thus offer too much flexibility within the programming requirements resulting in lack of strict adherence to scheduling specifications that are meant to ensure proper scheduling of the work.

2.6.3. Poor personal liaison of planners with others

Planners are often isolated from formal administration channels due to the nature of their work and this creates difficulties for them in gathering of information (Laufer, et al., 1994). Planners are also not always completely open on their programs, particularly with the employer, probably for fear that their own programs could be used to defeat any of their claims (Revay, 2000). Conversely, this lack of openness makes the employer very cautious about being tied to a contractor's program. Apprehension of this sort is likely to affect proper preparation and maintenance of programs.

2.6.4. Lack of proper communication

According to Laufer et al. (1994), timely, reliable and clear information gathering and distribution is a central issue in planning during construction. Thus improper communication between project stakeholders particularly site managers, subcontractors and architect/engineer team will affect the availability of information for effective

programme management. For instance, the practice of issuing verbal instructions and hand drawn sketches by the designer's site representative without a confirmation by the contractor (as some contract forms require), often result in difficulty in finding project records when investigating causes of delay some time later. Another example is the situation where the architect or engineer issues a drawing under cover of instructions, letters, transmittal sheets and other forms, without distinguishing between explanatory details and changes to the original design. This practice may not facilitate possible review of effects on programme and thus contributes to failure by the contractor to give notice of delay, or extra cost at the earliest possible time.

2.6.5. Inadequate Planning Effort

A study by Faniran et al. (1994) shows that the extent to which emphasis is placed on the determination of construction methods during planning has a significant effect on the improvement of construction planning effectiveness. However one major deficiency in construction planning practices is over-emphasis on scheduling and control at the expense of methods. In addition, relatively little effort is made by physical planners to seek required additional information during planning with the usual practice being to feed deterministic planning models with pure guesswork data (Laufer and Tucker, 1987)

2.6.6. Inefficient Allocation of Construction Planning Resources

Construction planning effectiveness can be improved by increasing the amount of resources invested in construction planning (Faniran et al., 1994; 1998). However, there is evidence also that over investing in construction planning can also lead to deterioration of project performance (Neale and Neale, 1989). Therefore inefficient allocation of resources for construction planning has the potential of negatively affecting project performance.

2.6.7. Poor Involvement of Field Personnel

Effective programming requires the involvement of many parties (Laufer, et al., 1994). More importantly, field supervisors must be totally familiar with and in agreement with all details of the program of works. Baki (1998) states that the more input the person responsible for carrying out the plan has in the development of the plan, the more likely it

is to be followed. However, earlier research in UK (Cullen and Nankervis, 1985) indicated that field personnel are often excluded from strategic planning and from receiving planning information. This exclusion would work detrimentally against scheduling process thereby resulting in deficiencies in programs of works that could have been avoided had the field personnel been consulted.

2.6.8. Insufficient time and information for proper tender preparation

Adequate planning time prior to commencement of work on site is one of the factors significantly responsible for effective planning (Faniran et al., 1994). However, research by Kelsey et al. (2001) shows that most planners work under shorter time constraints during tender preparation which may affect the quality of pre-contract programs submitted with the contractors' tenders. The planners interviewed in that research also complained of consistently poor quality and insufficient information for tender program preparation leading to guessing for missing information. This affects the use of the tender programs as proper bases for construction programs or sometimes for assessing extensions of time when it is the only program available prior to experiencing delays.

2.6.9. Inadequate Contractual Provisions for Programming

Most contract documents do not have adequate provisions and sufficient emphasis for effective preparation and maintenance of contractors' construction programmes (Thomas 2001; Pickavance, 2005). Scheduling specifications that lack important programming requirements offer an advantage to unscrupulous contractor. It is only in the US where most conditions of contract require a schedule in CPM or PERT format with a requirement to update periodically a work schedule to reflect contract performance (Wickwire et al., 1989).

2.6.10. Contract Administrator's Programming Expertise

For prompt and proper assessment of extensions of time claims, most forms of contract require the contractor to provide timely notice of delay and its particulars to the contract administrator. According to Thomas (2001) it is not uncommon for contractors to provide

brief information (if at all) on particulars of delay events making it difficult for the contract administrator to assess properly the effects of delay.

Presumably the contract administrator might be expected to identify all relevant particulars required to make a decision on the extension of time and ask the contractor to supply them. Some contract forms require the contract administrator to consider the reasonableness of the contractor's endeavour to prevent or minimize delay and the effect of all other events even if not notified by the contractor when reviewing extension of time claims. As a result of these responsibilities, contract administrators with inadequate expertise on analysis of the program of works would not facilitate proper maintenance of program of works for effective delay assessment.

2.6.11. Programmes manship

This is a ploy used by contractors by deliberately submitting over-optimistic program of works in the hope of sustaining a delay claim even if the contract is completed within the contract period. Typical examples include a contractor's program of works having unrealistic early completion date, artificial logic to exaggerate known delay, artificial activity durations and logic to hide float (Zack, 1993).

2.7. Appropriate Framework for the Preparation of a Program of Works

Formal scheduling procedures have become much more common with the advent of computers on construction sites and easy-to-use software programs. Sharing schedule information via the Internet has also provided a greater incentive to use formal scheduling methods. Savvy construction supervisors often carry schedule and budget information around with wearable or handheld computers. As a result, the continued development of easy to use computer programs and improved methods of presenting schedules and have overcome the practical problems associated with formal scheduling mechanisms. But problems with the use of scheduling techniques will continue until managers understand their proper use and limitations (Hendrickson, 1989).

Contractors and consultants often resort to delay and disruption (DD) analysis methodologies that are incapable of producing results of high accuracy or reasonable precision/certainly, which is a recipe for disputes on DD claims. Problems related to programming and record keeping practice have made the use of more accurate methodologies less amenable as they require detailed and accurate programmes and project records to implement.

2.8. Literature Gap

Literature on the quality and usage of the program of works in construction projects in Kenya is scanty. As pointed out in Braimah (2008) much of the research effort that has gone into finding solutions to the problems of delays and disruption have so far focused on developing methods for *estimating* the construction period (for example Kivaa 2000 and Muoria 2012) and *analyzing* the delays and disruptions (for example Gichunge 2000 & Talukhaba 1999). The studies have not addressed the quality or usage of the program of works used in the industry.

This study opts to fill this gap by investigating the actual influence of the program of works on delays and disruptions in public projects. It also looks at all the aspects of the program of works which may need refinement in order to foster efficiency in project delivery. Eventually, it brings out the underlying challenges faced by contractors in their project planning and control, so that an appropriate framework for minimizing delays and disruption in construction projects can be developed accordingly.

2.9. Theoretical Framework

The concept of project scheduling is domiciled in scientific management, whereby the work to be executed is broken down into its constituent activities. According to Gulick & Urwick (1937), the tenets of the scientific school of management thought may be summarized as follows: -

a. Scientific management is a whole-hearted attempt to deal with every question arising from the conduct of business, or indeed any human system of co-operation,

in the temper and spirit of the scientist and by using tools of definition, analysis, measurement, experiment and proof. It is the substitution of inductive thinking (thinking based on facts), for the old deductive thinking (thinking based on theories or opinions) in all matters concerning the organization of human groups.

b. There is a primary focus on work itself and not the particular person doing the work. The good worker is viewed as one who accepts orders but does not initiate actions. The worker is told how to do his job based on the scientific analysis of the job. Focus is at this basic work-worker level, typically in a production shop. Scientific management does not emphasize the integration and co-ordination of higher levels of the organization.

c. Scientific management assumes rationality in the classical sense each worker is assumed to be the classical "economic man," interested in maximizing his monetary income. The organization is seen as a rational instrument of production. The complicated motivational, emotional and social actions and reactions of persons in organizations are not emphasized.

There are two major implications of these assumptions. *Firstly*, the scientific management approach strongly upholds the practice of close supervision of subordinates, subdivision of tasks into their elementary components that are most easily learnt and which require simple repetitive operations and a detailed standardized form of doing work as established by management. Indeed scientific management approach regards the worker as an important tool or machine in production whose behaviour can be regulated and controlled to the desired level of efficiency to increase production. *Secondly*, the practical application of these concepts in a construction project requires a project schedule which is relatively more comprehensive than the programs of works found in construction projects in Kenya today.

A relatively more comprehensive program of works offers the contractor a higher chance of excellence in the project delivery. From the literature reviewed - particularly Braimah (2008), Zafar & Rasmussen (2001) and Kursave (2003) - the incidence of project delays and the impact of progress disruptions should be considerably reduced by the more comprehensive programs of works. Therefore all the aspects of the program of works –

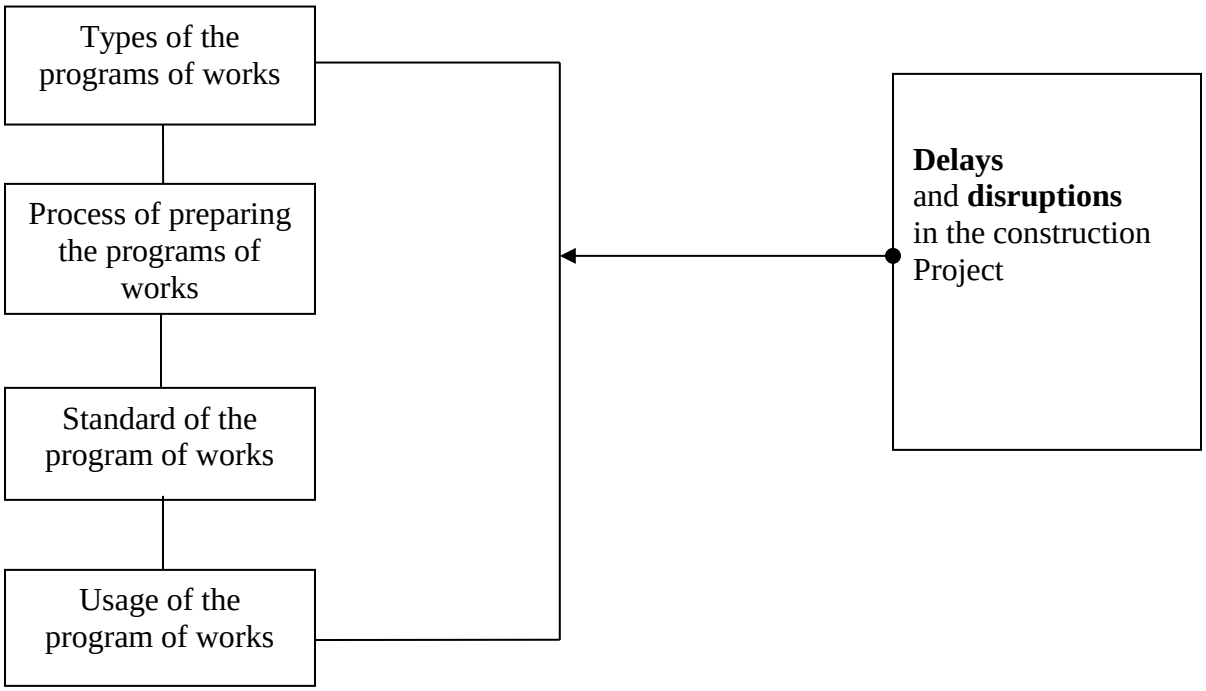
standards specified in the tender documentation, *process* of schedule preparation, *usage* of the schedule in the project monitoring and control, and timely *updating* of the schedule – are likely to influence the contractor's performance in project delivery.

2.10. Conceptual Framework

The relationships amongst the variables in this study may be diagrammatically illustrated as shown in Figure 2.1.

Fig 2.1: Conceptual Framework

Explanatory Variables	Dependent variable
Appropriateness of the Framework of the Project Scheduling	**Contractor Performance in Project Delivery**



Source: Researcher (2016)

Note: Arrow ⟶ means "caused by"

The independent variables in this study are: (i) type of program of works; (ii) process of the preparing the programs of works; (iii) standard (i.e. quality) of the program of works; and (iv) usage of the program of works. The explanatory variables may collectively be

termed as the *appropriateness of the framework of scheduling* in the project. The dependent variable is the contractor performance in the project delivery, whose indicators are the project delays – length and frequency – and the progress disruptions (severity of impact).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter focused on the research design, target population, sample and sampling procedures, research instruments, instruments validity and reliability, data collection procedures and data analysis procedures.

3.2. Research Design

Borg and Gall (1989) view a research design as a logical and valuable way of looking at the world. This study adopted both qualitative and quantitative research methods mixed methodology. The use of quantitative and qualitative methods in social research has been widely discussed as both methods have their advantages and disadvantages. This study opted to incorporate both methods in order to offset the weaknesses of each by drawing on the strength of the other. In the recent years the use of a mixed method research has become increasing common (Bryman, 2006).

There are two main types of surveys: cross-sectional and longitudinal studies. In a cross-sectional survey, data is collected on relevant variables at the same time or within a relatively short space of time. Longitudinal surveys on the other hand involve collecting data over long periods of time by taking measurements of the variables over two or more distinct periods. This type of survey were eliminated as inappropriate in the light of the time and resource constraints within which the research had to be completed, leaving cross-sectional survey as the most appropriate.

3.3. Sources of Data

Data for this study formed Client Ministry Officers, project managers' representatives, contractors and public works records under the Ministry of Lands, Housing and Urban Development. This mainly involved the projects registers at the Ministry.

3.4. Target Population

The target population for this study was contracts which had been undertaken in housing constructions under the government of Kenya in the in the last five years (2011 to 2016), while the respondents were the client Ministry Officers, Project Managers representatives and other key players in these projects. The number of these projects – ongoing and completed - was about 100 No. Out of these, the researcher decided to study only the completed projects because a completed project is likely to reveal the influence of the program of works more fully than an ongoing project. Additionally, the researcher considered only the public housing projects in the Nairobi City County, for practical reasons – time and financial limitations. Eventually, a sample size of 22 No. projects was selected for the study.

3.5. Sampling Technique

Purposive sampling was used in sampling of projects in the Ministry's register which have been undertaken in the last five years. Then, snowball sampling was used to identify key informants – contractors, project managers, etc - for each of the selected projects.

3.6. Data Collection Instruments

The study employed the use of two sets of research instruments: an in-depth interview schedule, questionnaires and document analysis guide.

3.7. Data Collection Procedures

Interviewees were contacted to arrange for appropriate interview date, time and place. Closer to the interviews, copies of the interview questionnaires were availed to the interviewees with an accompanying cover letter, reminding them of the time and date for the interview. Although there are various methods for administering interviews, the most pervasive one in qualitative studies is personal or face-face interviews as it allows observations to be made and also enables the researcher to interact with the natural setting (Creswell, 2003).

For each interview, interviewees were first be briefed on the purpose of the interview and its expected duration. They were also assured that information received was to be kept strictly confidential and their consent further sought on note taking by writing and tape recording. In the course of the interviews, a number of steps were taken, to ensure its proper conduct and avoid any possible biases from creeping in, including:

a) asking one question at a time;
b) remaining neutral as far possible by trying not to show strong emotional reactions to responses, for instance; and
c) Taking control of the interview by sticking closely to questions of interest.

3.8. Data Analysis Procedures

The data collected was analysed, with the aid of Statistical Program for Social Sciences (SPSS for Windows, Version 20) and Excel and adopted descriptive statistics – frequencies and percentages. Data collected from the questionnaire survey and structure interviews were used to draw deductions and conclusions in respect of the research objectives.

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1. Introduction

This chapter presents the findings of the study. The data analysis results are presented in four main sections: importance of the program of works, factors considered in preparing a work schedule, deficiencies in the programs of works that lead to delay and disruptions of works in the construction project, and the underlying causes of deficiencies in the program of works in the construction industry. Finally, it is concluded that the fundamental challenges are expertise in the schedule preparation and project funding.

4.2. The Response Rate

A sample of 22 construction sites located within Nairobi City County were purposively selected as current Public Works projects for the period of the last 5 years – 2011 to 2016. Questionnaires and direct observations were used as the main instruments of data collection in the study. The respondents were mainly the site supervisory staff or the construction site managers who had been contracted to handle the public works projects.

From the sample size of 22 members, 15 (68.18%) positively responded to the survey request. The percentage of those interviewed is statistically adequate to represent the whole. According to Babbie (2007), any return rate over 50% can be reported, that over 60% is good, and that over 70% is excellent as indicated by the survey's response rate. The response rate is further summarized as indicated in Table 4.0 below.

Table 4.0: The Response Rate

Category	**Questionnaires Sent**	**Questionnaires Returned**	**Response Rate (%)**
Site Supervisory Staff	**22**	**15**	**68.18%**

Source; Author, 2016

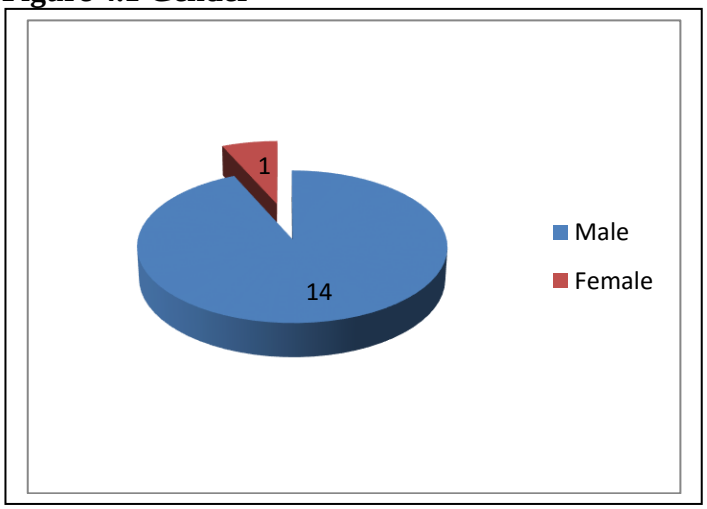
Mugenda and Mugenda (2003) further assert that in questionnaire administration, a response rate of 50% is adequate for analysis and reporting. They further suggests that 60

percent is good response while 70% is very good. The researcher therefore considers that the general response rate of 68.18% is good and sufficient for data analysis, reporting and drawing conclusions.

4.3. General Information on the Respondents

From the 15 respondents positively obtained during the survey, 14 (93.3%) were male supervisors or site managers and only 1 (6.7%) were female site supervisors or site managers. This indicates a wide gender disparity in construction site management. Figure 4.1 below illustrates these variations. Majority of 66.7% were degree holders from university, tertiary college were 26.7% and Secondary School were 6.7% as indicated in the Table 4.1 below.

Figure 4.1 Gender



Source; Field Survey, 2016

Table 4.1. Level Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary	1	6.7	6.7	6.7
	Tertiary/College	4	26.7	26.7	33.3
	University	10	66.7	66.7	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

80.0% of the respondents had training on construction management while 20.0% had never had any training on construction management; this indicated the level of the understanding of the concept of program of works within the construction industry as indicated by Figure 4.2 below. 53.3% obtained the training as unit or part in civil engineering training, 13.3% as part of study in Architecture and 6.7% as Masters in Science, Civil Engineering. The awarding body or institutions were as indicated in Table 4.2 below.

Table 4.2 Awarding Body/Institution

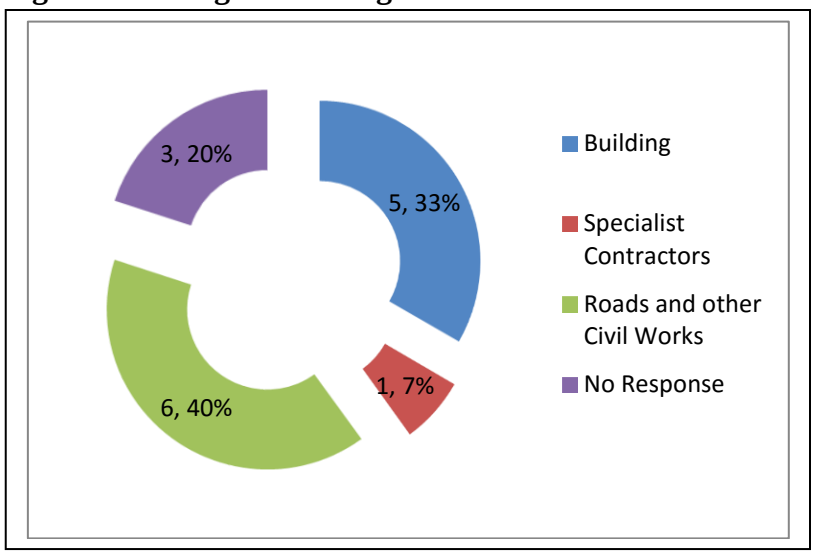
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	KNEC	4	26.7	26.7	26.7
	University	7	46.7	46.7	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

73.3% were registered contractors while 26.7% had not been registered as contractors. The categories and classification of the registration of the contractors are as indicated in the Figures 4.3 and 4.4 below.

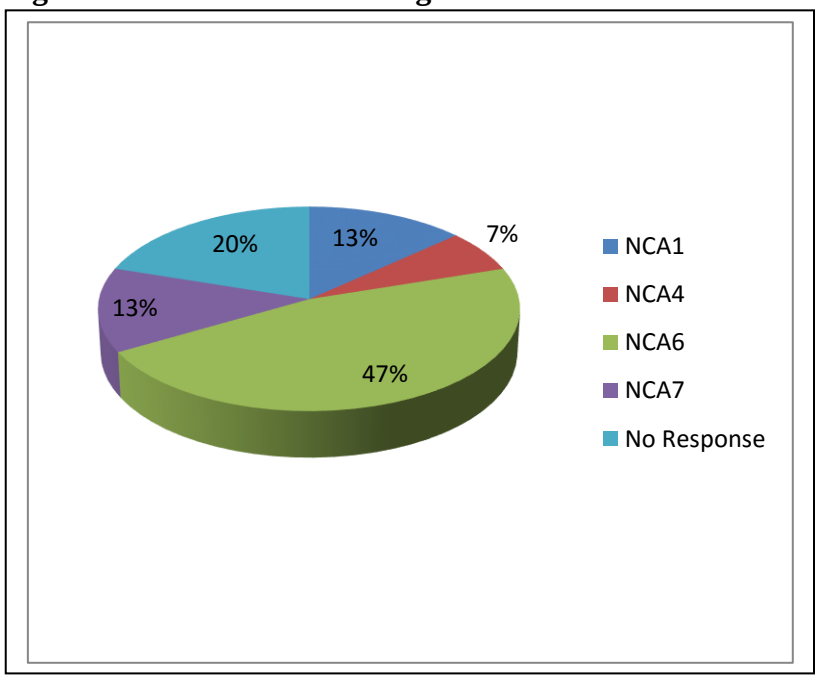
The kind of the projects that the contractors were involved in were Bungalow residential units 26.7%, Mansionettes 13.3% and Flats 60.0%. 40.0% of the respondents identified as project engineers, 33.3% as contractors. The scope of work for the projects were mainly full construction works 60.0% and skeleton of building, roofing and finishing 33.3%.

Figure 4.3 Categories of Registration



Source; Field Survey, 2016

Figure 4.4 Classification of Registration



Source; Field Survey, 2016

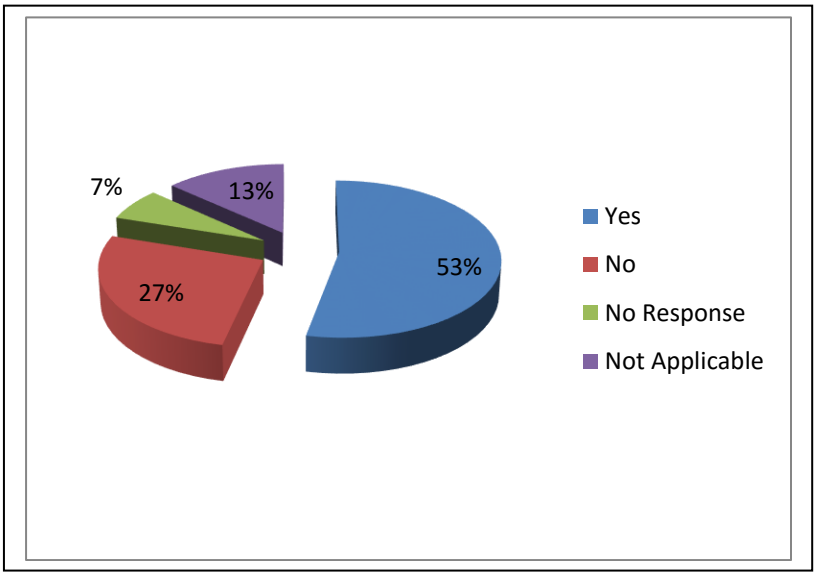
4.4. Importance of the Program of Works

In an attempt to determine the importance of program of works in construction management, the research sort to find out if the public works projects had a work schedules.

80% of the respondents acknowledged the availability of work schedules for the different projects while 20.0% indicated otherwise.

Adherence to the program of works is illustrated by Figure 4.5 below.

Figure 4.5 Adherence to Program of Works



Source; Field Survey, 2016

100% of respondents noted that the program of works is prepared during the project planning, mainly before the project commence.

Table 4.3 illustrates those involved in the preparation of programs of work of which the contractors stand at 53.3% and project engineer at 26.7% and clerk of works at 20.0%. The preparation of program of woks is mainly done by the use of software as indicated by 77.3% of the respondents. 26.7% of the respondents. 26.7% of the respondents do the preparation manually. The program of work serves the purpose of work efficiency by 66.7% and capture of important actors of the project by 6.7%. 100.0% of the respondents consider program of work to an important item construction management as it helps in planning stages of work, saves time and improve efficiency.

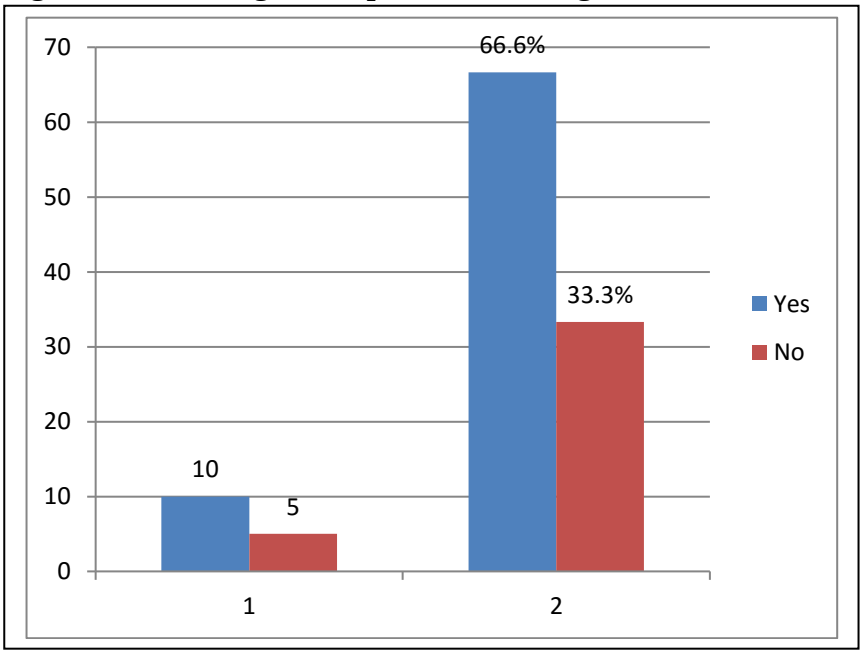
Table 4.3 Involvement in the Preparation of the Program of Works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The contractor	8	53.3	53.3	53.3
	Project engineer	4	26.7	26.7	80.0
	Clerk of works	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

The figure 4.6 below indicated the levels of background training on the preparation of program of work. The background training is mainly basic as indicated by 40.0% while full knowledge training for 26.7%.

Figure 4.6 Training on Preparation of Program of Works



Source; Field Survey, 2016

The program of works has proved to be of importance during the career of the contractors interviewed. 53.3% noted it helps a lot in profitability, offer guidance for activities to be followed and 33.3% noted it has been useful in all the project the have handled and all the time in construction management.

4.5. Factors to consider in Preparation of Work Schedule

In the determination of factors to considered in the preparation of work schedule, 80.0% indicate critical activities as the main factor, types of project followed by 13.3% and complexity of projects at 6.7%. This is illusrated in Table 4.4 below. The findings concluded that critical activities are the most important factor to be considered when preparing program of works.

Table 4.4 Factors Considered in Preparing a Program of Works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Complexity of Projects	1	6.7	6.7	6.7
	Criical Activities	12	80.0	80.0	86.7
	Type of projects involved	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

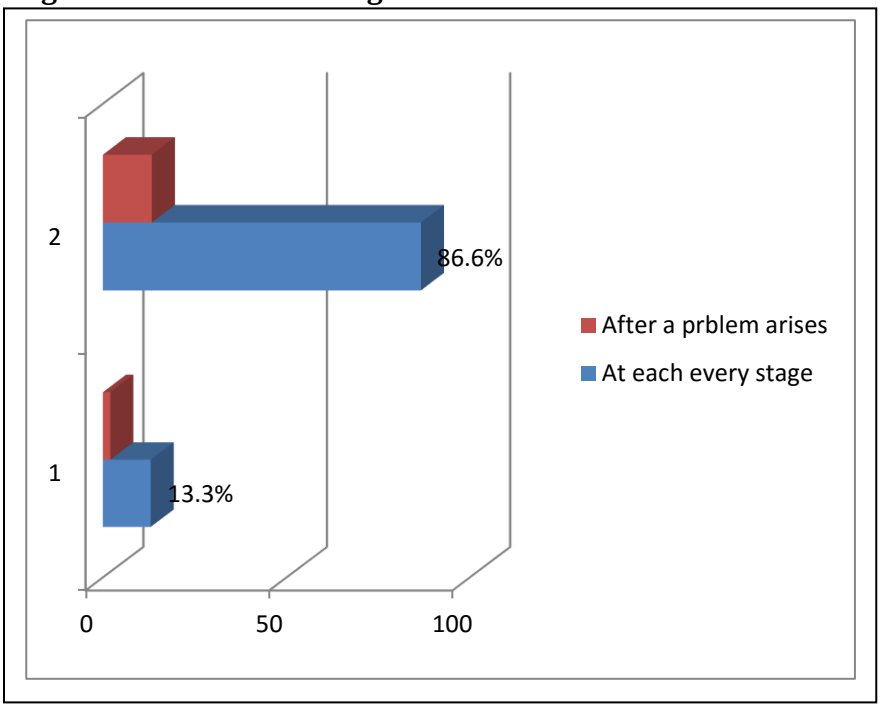
How often the program of works is reviewed during the construction process is illustrated by Figure 4.7 below, where 86.6% of the respondents noted that this is only done when a problem arises while 13.3% acknowledged they review the program of works at every stage of the construction process. The type of the program of works in use of the projects handled by the contractor, were mainly time oriented program of works at 86.7% and resource oriented at 13.3%. This illustrated by the Table 4.5 below.

Table 4.5 Type of the Program of works in the Project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Resource oriented	2	13.3	13.3	13.3
	Time oriented	13	86.7	86.7	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

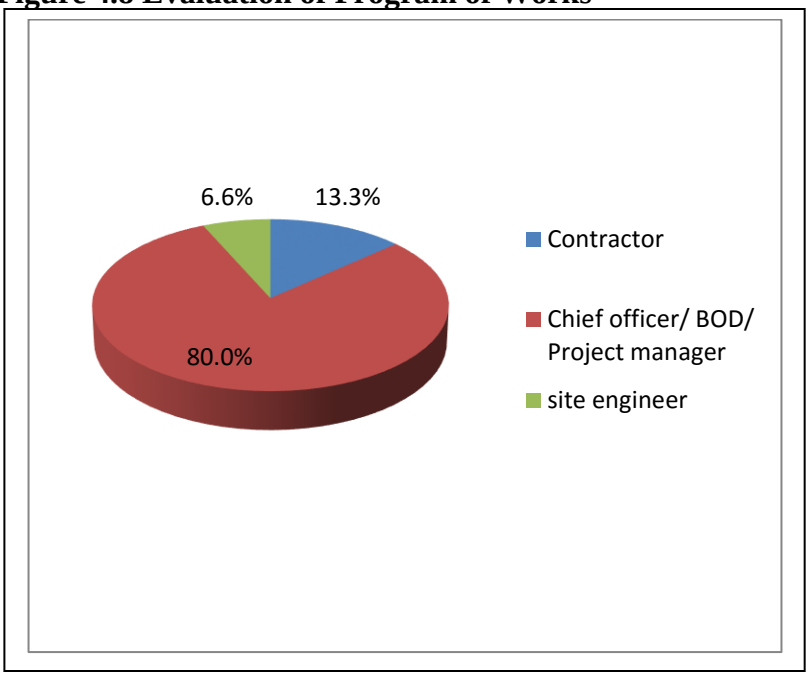
Fugure 4.7 Review the Program of Works



Source; Field Survey, 2016

The respondents indicated that the planning done to the projects was mainly every stage being allocated time by graphical illustration by 46.7% and finance and time allocation at 26.7%. 53.3% indicated that every of the projects they handled had a program of work. Evaluation of the program of works after preparation was mainly done by the project manager as indicated by 80.0% of the respondents, contractors at 13.3% and site managers at 6.7%. See Figure 4.8 below. Other factors considered when preparing a program of works were mainly labour force at 26.7% and finances at 33.3%.

Figure 4.8 Evaluation of Program of Works



Source; Field Survey, 2016

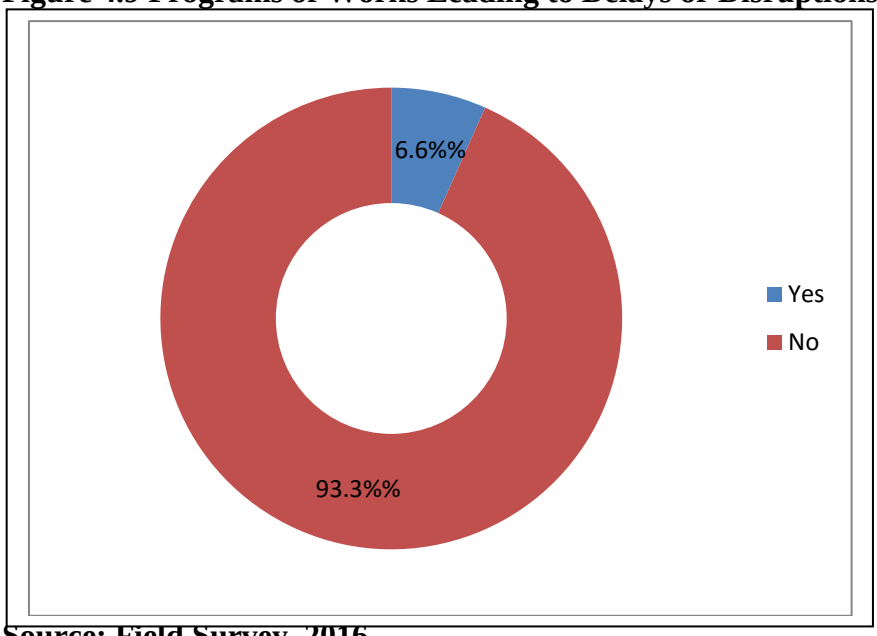
4.6. Deficiency in Programs of Works

100.0% of the respondents acknowledged that the program of work is an efficient tool in the management of projects. 80.0% noted that it helps manage projects within the allocated time and helps in productivity. 73.3% indicated the program of works aid in meeting construction timelines by proper observation of works. In the planning to avoid likely delays during the construction process, 73.3% of the respondents noted that the program of work can be adjusted and time changed for the different stages, and even catching up with time lost. In the planning to avoid disruption during the construction process, 60.0% of the respondents noted that the program of works can help in the identification of the sources of disruptions.

Figure 4.9 below illustrate whether the program of works leads to delays and disruptions. 66.7% of the respondents noted that with good timeline, it is not easy for the program of works to either disrupt or delay works while 6.7% noted that it can lead to delays and disruption when the program of works is not adhered to. 40.0% of the respondents noted that they had not experienced any shortcomings through the program of works during

construction while 33.3% noted that when all elements are not captured in the program of works, then there are likely shortcomings. The short comings impact on the projects mainly through the delays as noted by 40.0% of the respondents.

Figure 4.9 Programs of Works Leading to Delays or Disruptions



Source; Field Survey, 2016

4.7. Causes of Deficiency in Programs of Works

In the analysis of the respondents' perception on the identified factors that causes deficiency in the program of works, poor preparation as a cause of deficiencies in program of works was perceived as a cause to very great extent by 33.3%, great extent by 46.7%, not at all by 6.7% and to very little extent 13.3%. This is illustrated by Table 4.6 below.

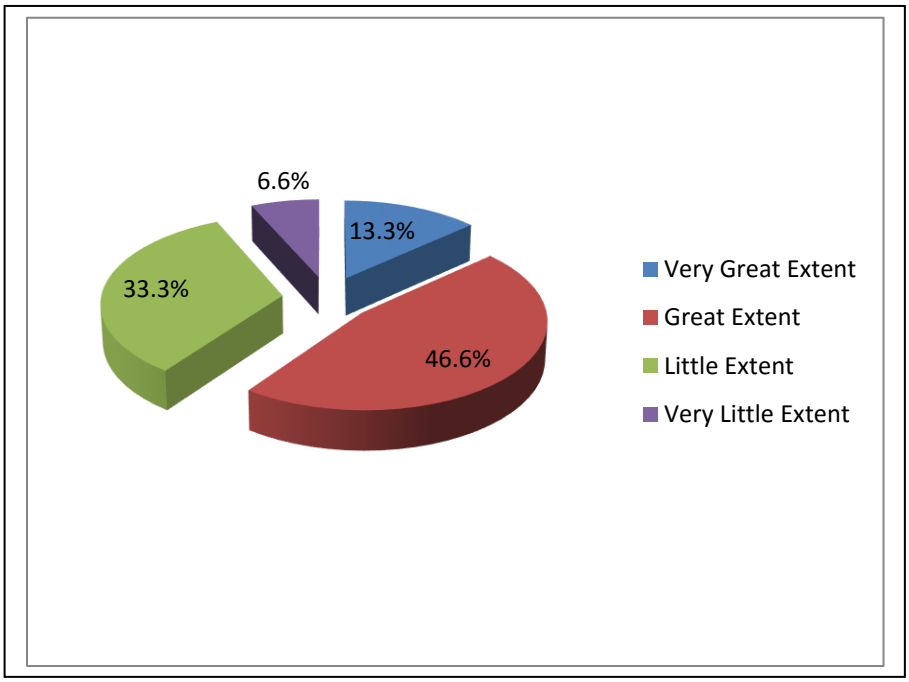
Table 4.6 Poor Preparation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	5	33.3	33.3	33.3
	Great Extent	7	46.7	46.7	80.0
	Not at all	1	6.7	6.7	86.7
	Very Little Extent	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

Failure to update program of works was perceived as a cause of deficiency in program of works to very great extent by 13.3%, great extent by 46.7%, little extent by 6.7% as illustrated by Figure 4.10 below.

Figure 4.10 Failure to Update Program of Works



Source; Field Survey, 2016

Inadequately updated program of works was perceived as a cause of deficiency in the program of works to a very great extent by 6.6%, great extent by 53.3%, not at all by 20.0% and little extent by 20.0%. This is illustrated by Table 4.7 below.

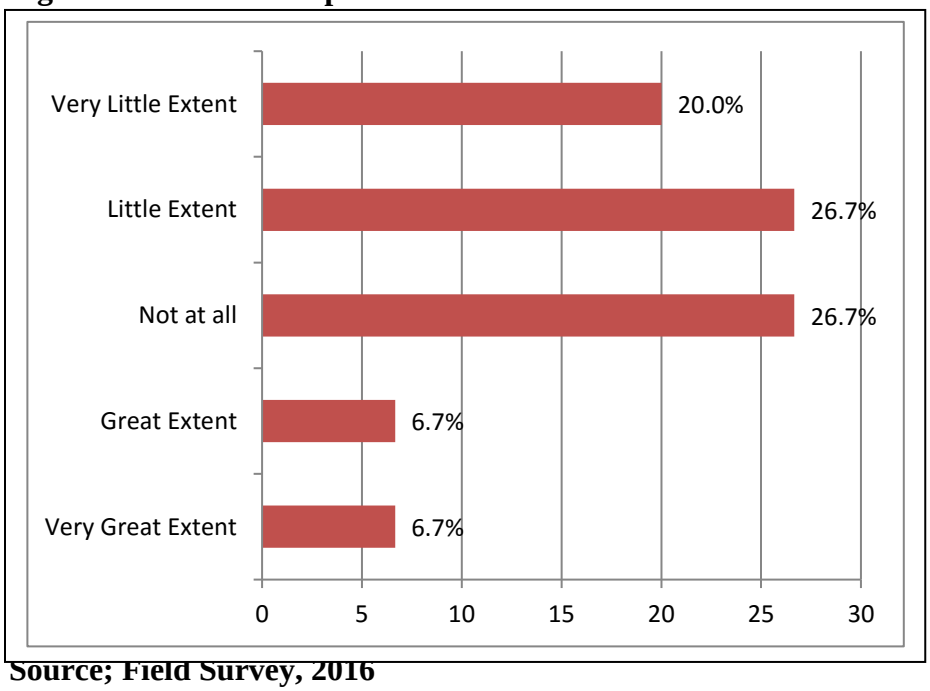
Table 4.7 Inadequately updated programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	1	6.7	6.7	6.7
	Great Extent	8	53.3	53.3	60.0
	Not at all	3	20.0	20.0	80.0
	Little Extent	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

Cost of preparation was perceived as a cause of deficiency in the program of works to vey great extent by 6.7%, great extent by 6.7%, not at all by 26.7%, little extent by 26.7% and very little extent by 20.0%. This is as indicated in Figure 4.11 below.

Figure 4.11 Cost of Preparation



Source; Field Survey, 2016

Lack of understanding of scheduling techniques was perceived as a factor that cause deficiency in the program of works to very great extent by 33.3%, great extent by 40.0%,

not at all by 6,7%, little extent by 13.3% and very little extent by 6.7% as illustrated by Table 4.8 below.

Table 4.8 Lack of Understanding of Scheduling Techniques

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	5	33.3	33.3	33.3
	Great Extent	6	40.0	40.0	73.3
	Not at all	1	6.7	6.7	80.0
	Little Extent	2	13.3	13.3	93.3
	Very Little Extent	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Source; Field Survey, 2016

Other factors that lead to deficiencies in the preparation of program of works further identified by the respondents were lack of scheduling skills indicated by 33.3% and failure to adhere to the program of works as indicated by 6.7% of the respondents.

4.8. Conclusion

In a nutshell, the problems faced by contractors are poor participations, failure to update program of works, inadequately updated programs, inadequate planning expertise, poor enforcement of the program of works, poor personal liaison of planners with others, lack of construction management skills, improper contract documentation, bad contract management skills, the type of working relationships employed, lack of facilities and equipment, non communication skills, and inefficient allocation of construction planning resources. All these arise because of lack of proper planning by the contractors and also due to financial difficulties which may be either contractor-related or client-related.

CHAPTER FIVE

DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The purpose of this study was to investigate the role of the program of works in contributing to delays and disruptions in construction projects, taking the case of the public works projects in Nairobi. The objectives of the study were: to investigate the importance of the program of works in the construction industry, to establish the factors considered when preparing a work schedule, to investigate deficiencies in programs of works that lead to delay and disruptions of works in the construction industry, and to establish the causes of deficiencies in the program of works in the construction industry. Accordingly, research questions were formulated, and then the researcher set out to look for answers. With a sample of 22 public works projects in Nairobi selected purposively, the researcher used questionnaires and direct observation to gather information related to the study. The data were analyzed, and study findings presented in the previous chapter. This chapter therefore presents a discussion of the study findings, the study conclusions and the recommendations based on the findings. Finally, areas for further research work are highlighted.

5.2. Discussion of the Study Findings

There are four categories of findings in this study, namely: (a) importance of the program of works; (b) adherence levels to the program of works; (c) factors considered in program preparation; and (d) causes of deficiency in the program of works.

(a) Importance of the Program of Works: The importance of the program of works cannot be overemphasized. From the data analysis results in this study, the program of works is considered to be an important tool in construction management, by the majority of project participants. This was indicated by 80.0% of the respondents, and is in line with the existing literature in this field of project planning and control.

From the literature reviewed in this study, the reasons why construction schedules or programs of works are considered important aids in project management are as follows: -

1) The schedule of works is useful when formulating a tender or bid estimates because:-

   i. It enables one to see whether the duration the client has stipulated is achievable. Who wants to win a project with an impossible duration where you could be penalized for completing it late? If you cannot meet the client's schedule submit an alternative bid based on your schedule, or don't bid for the project.

   ii. When one knows the overall project duration one can calculate the overhead costs (preliminaries), which are the management, supervision and running costs.

   iii. If the schedule is resourced one can use it to either calculate, or certainly check, your tender estimate.

   iv. The tender schedule could also demonstrate to the client the obligations they need to fulfill (such as when they need to provide access or information).

   v. The tender schedule can be used to forecast the contractor's cash flow. More contractors have failed because of insufficient cash flow than because their projects lost money, and sometimes this is due to contractors taking on projects that are a drain on their cash flow because they are too large or have unfavorable payment conditions.

2) It is possible with a correctly constructed schedule to move the critical path through different activities. This process could either shorten or extend the overall project duration. By doing this the researcher was able on one project to shorten a 44 week schedule to 40 weeks. It is a bit like finding a route to a destination. Whether you're using Google Maps or an App on your Smart device, the program analyses thousands of routes and then provide several choices. Some routes may avoid tolls, while others are best when there is no traffic, while some have a shorter distance but longer duration.

3) With a properly resourced schedule it is possible to change the sequencing of activities and extend or shorten durations in such a manner that the use of resources is smoothed and optimized. This helps reduce the peak resource demands and maintains continuity of resources, eliminating resources having to be demobilized and then remobilized again at additional costs.

4) The schedule shows the team the goals/targets/milestones and when they must be met. It then shows the route that the team must follow – kind of like following a map to get to your destination. It provides the sequence of tasks to guide Project Managers and Supervisors as to which activities they need to be working on, and which are the next ones they should be planning for. Without this map or schedule you may find individuals in the team pulling and working in different directions, maybe even not knowing when the target must be achieved.

5) Schedules provide timelines when construction materials are required on the project site. Therefore, they can be used to monitor the progress of subcontractors and suppliers.

6) A project schedule provided to subcontractors when they tender, and which is then included in their contract document, reduces opportunities for them to misunderstand the construction project durations or resources required, which lessens the possibility of claims and disputes.

7) A resourced construction schedule allows you to plan the mobilization of resources. You know how many of which type of resource you need and when. I've walked onto many projects and found that they either had too few or too many resources because the Project Manager didn't understand the project schedule resourcing.

8) Many contractors see the schedule as an opportunity for the client to use it to bash and penalize them. Actually, it is as an opportunity to ensure that the client meets his obligations (such as providing access and information) timeously. An approved

project construction schedule is a valuable aid when preparing extension of time claims.

9) The schedule provides feedback on whether the construction work is proceeding according to schedule and whether the project will be completed in time. When it is detected that progress is slipping action can be taken to recover the slippage which may include bringing on additional resources or working extended shifts.

Despite the importance of the program of works, there are many construction companies which do not produce construction schedule because they are too scared to commit a completion date to the client, and are fearful that a schedule will create additional work for them. All the same, a properly constructed construction schedule provides an opportunity to efficiently manage the project and to ensure the client meets their obligations.

(b) Adherence Levels to the Program of Works: The adherence levels to the program of works of 53.3% indicated the emphasis the construction firms put to ensure the program of works is followed during the construction process. 100.0% of the respondents noted that the program of work is prepared during the project planning, mainly before the project commences. The main professionals involved in the preparation of program of works are contractors, project engineer and the clerk of works. The program of works is mainly prepared by use of software as indicated by 73.3% of the respondents. The programs of works enhance work efficiency and helps in the capture of important actors of the project and eventually saves time and cost.

(c) Factors Considered in Program Preparation: The main factors considered when preparing program of works were the criticality of the activities as indicated by 80.0%, type of project by 13.3% and complexity of the project noted by 6.7% of the respondents. Review of program of works during the construction process was mainly done when problem arises as indicated by 86.6%. The programs of works were mainly time oriented program of works and indicated by 86.7% and evaluation mainly done by the project

manager noted by 80.0%. Other factors considered when preparing program of works were labour force required for the project and the available finances for the project.

(d) Causes of Deficiency in the Program of Works: The causes of deficiency in the program of works were mainly poor preparations of program of works to a very great extent noted by 33.3% and great extent by 46.7% perceived by the respondents. Failure to update the program of works was noted to a great extent by 46.6% of the respondents, while inadequately updated program of works was to a great extent perceived by 53.3% of the respondents. Also, lack of understanding of scheduling techniques was to a very great extent noted 33.3% and to a great extent by 40.0% of the respondents. Other factors identified by the respondents were lack of scheduling skills and failure to adhere to the program of works, which were noted by 33.3% and 6.7% of the respondents, respectively.

5.3. Conclusion

In a nutshell, the program of works is an efficient tool for managing projects, for it enhances project efficiency by ensuring that the project timelines are met and that the project resources are saved. The main factors that need to be considered during the preparation of the program of works are the criticality of the project activities, the complexity of the project, and the type of the project. Factors that cause deficiency in program of works are: poor preparation, failure to update program of works, inadequately updated program of works and lack of understanding of scheduling techniques.

5.4. Recommendation

In line with the findings in this study, the researcher makes three recommendations. Firstly, the construction project manager should develop an appropriate framework – a sort of 'strategic plan' - for minimizing delays and disruptions, from the five factors considered in the schedule preparation-(i) activity definition; (ii) activity sequencing; (iii) activity duration estimating; (iv) schedule development; and (v) schedule control.), and manage the project accordingly to avoid the the underlying causes of the program deficiencies observed in this study. Secondly, all participants in construction projects should be appraised and/or re-trained – in Continuous Professional or Technical Development programmes - on

project scheduling and usage. Finally, every project manger should thoroughly evaluate the contractor's program of works before it is implemented in the project execution and continually ensure realistic and timely updating of the program.

5.5. Areas for Further Research

In the process of this study, three areas that need further research were observed as follows. Firstly, a study needs to be done on the extent to which the program of works takes account of the health and safety issues on a construction site. Another area for further research is application of more intensive data collection and analysis method in a similar study in order to regress the level of contractor performance on the adequacy of the program of works. Finally, client-related issues particularly delays in payments, which greatly affect the implementation of the program of works need to be investigated *vis a vis* the effectiveness of the program.

REFERENCES

Allens, A.R. (1994). "Quality Management in the Construction Phase of the Traditional Procurement System in South Africa: The Case of the Western Cape", University of Cape Town in Cape Town, Western Cape, South Africa.

Alwi, S.; Hampson, K. and Mohamed, S. (2002) Factor Influencing Contractors' Performance in Indonesia: A Study of Non Value-Adding Activities. *Proceedings of the International Conference on Advancement in Design, Construction, Construction Management and Maintenance of Building Structure*, Bali.

Babbie (2007): Cited in Harun N. H. 2010.

Baki, M. A., (1998): Scheduling and its Use in Today's Construction Industry, *Project Management Journal*, 1998, 7-9

Baldwin, J.R. et al (1971) Causes of Delays in the Construction Industry *Journal of the Construction Division,* ASCE Vol. 97, No. l02, November 1971, pp177-187

Braimah Nuhu (2008). *An Investigation into the Use of Construction Delay and Disruption Analysis Methodologies*. University of Wolverhampton.

Bramble, B. B. and Callahan, M. T. (2000). Construction Delay Claims, 3rd Ed., Aspen law & Business, Gaithersburg, MD.

Bromilow, F.J (1969) "Contract time performance: expectations and reality" *Building Forum*, Division of Building Research C.S.I.R.O. September 1969, pp70-80.

CIOB (1991): *A guide to good programming practice*, produced by the UK's Chartered Institute of Building (CIOB, 1991)

Chan, D.W.M. & Kumaraswamy, M.M. (1996) An evaluation of construction time performance in the building industry. *Building and Environment*, 31 (6), 569–78.

Laufer, A., Cohenca-Zall, D., Shapira, A., and Howell, G. A. (1994) Process of Planning During Construction. *Journal of Construction Engineering and Management*, ASCE, Vol. 120, No. 3

Creswell, J.W. (2003) *Research design: Qualitative, Quantitative and Mixed Methods Approaches*, 2nd edition, London: Sage.

Cullen, J. D., & Nankervis, C. W (1985): Overcoming the Luddite Factor: Some Behavioural Aspects of the Field Supervisor's Role In Construction Planning, *International Journal of Project Management*, Volume 3, Issue 3, Pages 131-192

Elinwa, A U and Joshua, M (2001) Time-overrun factors in Nigerian construction industry *Journal of Construction Engineering and Management*, 127 (5), 419-425.

Esthete and Langford, (1987): Cited in Scott 1991

Faniran, O. O., Oluwoye, J. O., and Lenard, D. (1994a). ‘‘Effective construction planning.’ *Construction Management and Economics*, 12, 485–499.

Faniran, O. O., Oluwoye, J. O., and Lenard, D. (1994b). ‘‘A conceptual process of construction planning for meeting client objectives.’’ *Journal of Real Estate and Construction*, Singapore, 4(1), 48–57.

Fayol, H (1949) *General and Industrial Management*. (trans. C Storrs). London: Pitman.

Dayana B. C., Formoso, C. T., Kagioglou, M. & Poon, A. C. (2003), Performance Measurement Systems for Benchmarking in the Construction Industry. …… *No Journal Name,* Issue No and Pages No.

Dayana, F. A., Ahmad N., Nasir, Asnul D. M., Mohd N. K. H, Mahani M. & Safarin N. (2013) Virtual Environment Courseware in Engineering Drawing to Enhance Students' Visualization Skills, *Proceedings of the Research in Engineering Education Symposium 2013*, Kuala Lumpur

Gichunge, H. (2000). *Risk Management in the Building Industry in Kenya*, University of Nairobi, PhD Thesis, Unpublished

Gorse, C A, Bates, M and Hudson-Tyreman, A (2006) Practicalities of delay analysis: retrospective analysis. In: Boyd, D (Ed) Procs 22nd Annual ARCOM Conference, 4-6 September 2006, Birmingham, UK, Association of Researchers in Construction Management

Gulick L. & Urwick L. Eds. (1937). Notes on the Theory of Organization. *Papers on the Science of Administration*, Institute of Public Administration, New York, NY, USA, 1–46.

Behm M. (2008). Rapporteur's Report: Construction Sector. Journal of Safety Research 39 (2008) 175–178

Gwaya A. O. (2015): *Development of a Project Management Evaluation Model for the Construction Industry in Kenya*, JKUAT, Kenya PhD Thesis, Unpublished

Harun N. H. 2010: *Digital Libraries Initiatives in Malaysia: Readiness and Perceived Conditions for Future Growth*, PhD Thesis, University of Malaysia.

Henry, A.L. (1994). *The Factors Associated with Insolvency Among Contractors in the South African Construction Industry: a Case Study of the Western Cape Region*. University of Cape Town in Cape town, Western Cape, South Africa.

Hendrickson C. (1989). Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders. Prentice Hall, USA.

Hillebrandt P. M. (2000): *Economic Theory and the Construction Industry* (3rd Edition), London, the Macmillan Press Ltd

Hong, X. Proverbs, D. (2003)"Cost certainty and time certainty: an international investigation" Built environment research unit, school of engineering and the built environment, university of wolverhampton, wv1 1sb, uk

Jaafari, A. (1984). Criticism of CPM for project planning analysis. *Journal of Construction Engineering and Management*. 110(2),

Keane, J. (1994) *A Computer-Aided Systematic Approach to Time Delay Analysis for Extension of Time Claims on Construction Projects.* PhD thesis, Department of Civil Engineering and Building, Loughborough University of Technology, Loughborough,UK.

Kelada, Joseph N. *(1999, ASQ)* Stakeholders Management: A Total Quality Approach, *Annual Quality Congress,* Anaheim, CA *Vol. 53 No. 0,* University of Montreal, Montreal, Quebec

Kelsey, J. Winch G. M., & Penn, A. (2001): Understanding the Project Planning Process, *Requirements Capture for the Virtual Construction Site*, University College London, London

Kivaa T. (2000): *Developing a Model for Estimating Construction Period; A Survey of Building Projects in Nairobi*, University of Nairobi, Masters Thesis, Unpublished

Klein R. (2002). A Better Way to sort out Delays. Article in *Construction News*, 10 January 2002. Society of Construction Law, UK.

Kursave, J. D. (2003) The Necessity of Project Schedule Updating and Monitoring, *Journal of Cost Engineering*, 45(7) 8 - 14

Laufer (1994): Construction Management and Economics Volume 12, Issue 6,

Laufer, A and Tucker, R.L. (1987) "Is construction planning really doing its job? A critical examination of focus role and process" *Construction Management and Economics* E & F Spon ltd, vol. 5 pp 243 - 266

Lobelo, L. (1996). "An Investigation into Factors Associated with Insolvencies Amongst Civil Engineering Contracting Firms in South Africa". University of Cape Town in Cape Town, Western Cape, South Africa.

Love, P.E.D., Smith, J., Li, H., (2000) "The propagation of rework benchmark metrics for construction", *International Journal of Quality and Reliability Management*, Vol. 16, No. 7., pp 638-658.

Mace, D. (1990). Problems of programming in the building industry. Chartered Builder.

Mbugua, L., Harris, P., Holt, G., & Olomolaiye, P. (1999). A framework for determining critical success factors influencing con struction business performance. *Paper presented at the Proceedings of the Association of Researchers in Construction Managemen*t 15th Annual Conference.

Mugenda, O.M. & Mugenda, A.G. (1999), Research Methods: Quantitative and Qualitative Approaches, 1st Edition, Published by ACTS: Nairobi, Kenya.

Muoria C. (2012): *Developing a Model for Estimating Construction Period in Road Projects*, JKUAT, Masters Thesis, Unpublished

Nahapiet, J. and Nahapiet, H. (1985). The management of construction projects: case studies from the USA and UK, The Chartered Institute of Building, England.

Neale, R. H. & Neale, D. E., (1989): *Construction Planning; Engineering Management*, Telford, California

Neely, A. (2005), The evolution of performance measurement research: development in the last decade and a research agenda for the next. *International Journal of Operations & Production Management*, Vol. 25 No. 12, pp. 1264-77.

Ofori and Chan (2001): cited in Alwi et al (2002).

Pamulu M. S. (2010). Strategic Management Practise in the Construction Industry: A studt of Indonesian Enterprises. Queensland University of Technology.

Pickavance, K. (2005) *Delay and Disruption in Construction Contracts* 3ed, London, LLP.

PMI - Project Management Institute - (1996): *A Guide to the Project Management Body of Knowledge*, PMI, Newtownsquare, USA

Revay & Associates (2000): Lessons Learned From 30 Years of Handling Construction Disputes, The *Revay Report*, (2000): Vol. 19,No. 1 , January.

Republic of Kenya (2005) *Economic Review* 2005, Government Printer, Nairobi, Kenya

Sambasivan M. and Soon Y. W. (2006). Causes and effects of delays in Malaysian construction industry. International Journal of Project Management 25 (2007) 517–526

Scott, S. (1991) *Project Plans and Record Keeping in Construction Sites in the United Kingdom*, PhD Thesis, University of New Castle, UK.

Scott, S. (1997) Delay Claims in UK Contracts, Journal of Construction Engineering and Management, ASCE, Vol. 123, No. 3.

Sinclair, D. and Zairi, M. (1995), "Effective Process Management through Performance Measurement: Part I – Applications of Total Quality-Based Performance Measurement", *Business Process Re-engineering & Management Journal*, Vol. 1 No. 1, 1995, pp. 75-88.

Stevens, M. (2002) Ed. Project management pathways, High Wycomb. The association for Project Management.

Street, I. S. (2000). The Pitfalls of CPM Scheduling on Construction Projects. *Cost Engineering* 42(8):35-37

Talukhaba A. A. (1999). An investigation into factors causing construction project delays in Kenya case study of high rise building projects in Nairobi. University of Nairobi.

Takim, R., Akintoye, A and Kelly, J (2003) Performance Measurement in Construction, *Proceedings, ARCOM, 19th Conference*, Vol.1, Brighton, pp 423 – 431

Thomas, R. (2001) *Construction Contract Claims* New York: Palgrave Macmillan

Ward, P. (2005) The SOCL'S delay and disruption protocol and the Australian construction industry. Proceedings of the 21st Annual Conference of the Association of Researchers in Construction Management. 7th – 9th September, SOAS, London

Wickwire et al (1989): Cited in Braimah 2008

Xiao, H. & Proverbs, D. (2003) Factors influencing contractor performance: an international investigation *Engineering, Construction and Architectural Management* Volume 10, Number 5, 2003 pp 322-332

Yogeswaran, K., Kumaraswamy, M. M., and Miller D. R. A. (1998) Claims for extension of time in civil engineering projects. Journal of Construction Management and Economics, Vol. 16

Zack, J. G. (1993) Claimsmanship: Current Perspective. Journal of Construction Engineering and Management, ASCE, Vol. 119, No. 3, Sept.

Zafar and Rasmussen (2001): Understanding Construction Delay Analysis and the Role of Preconstruction Programming, *Journal of Management in Engineering*, Vol. 30 Issue 5

APPENDICES

APPENDIX I - QUESTIONNAIRE

I am a **Mwilu Stephen Munyao, a postrgraduate** student at the University of Nairobi undertaking a Masters Degree in Construction Management at the School of Built Environment. As part of the requirement for the degree, I am undertaking a research project that seeks to:

"Investigate the Role of the Program of Works in Timely Completion of Construction Projects In Kenya."

(Case of Public Works Building Projects in Nairobi)

I kindly request your participation in this study by filling in this questionnaire. The information obtained is intended purely for academic purposes only and will be treated with utmost confidentiality. (Please fill in the gaps and tick where appropriate).

Section A: General Information

1. Gender
   a) Male ☐ b) Female ☐
2. What is your Level Education?
   a) None ☐
   b) Primary ☐
   c) Secondary ☐
   d) Tertiary/College ☐
   e) University ☐
3. i) Do you have any training on Construction Management?
   a) Yes ☐ b) No ☐
   ii) If yes, please state?.....
   iii) Please indicate the awarding body/institution (for ii above).....
   .....

4. i) Are you a registered Contractor?

   a) Yes ☐ b) No ☐

   ii) If yes, what category is your registration?

   a) Buildings ☐

   b) Specialist Contractors ☐

   c) Roads and other Civil Works ☐

   iii) What is the classification of your registration?

   a) NCA 1 ☐ b) NCA 2 ☐ c) NCA 3 ☐

   d) NCA 4 ☐ e) NCA 5 ☐ f) NCA 6 ☐

   g) NCA 7 ☐ h) NCA 8 ☐

   ii) If any other, please specify? .....

5. What kind of project is this?

   a) Massionnate ☐

   b) Bungalow ☐

   c) Flats ☐

   d) Any other, please specify?

6. What is your title in the project?

7. What is the scope of work for this project?

   .....

Section B: Importance of the Program of Works

8. i) Does the Project have a work schedule?

   a) Yes ☐ b) No ☐

   ii) If yes above, have you been adhering to it?

   a) Yes ☐ b) No ☐

iii) If No, above, why not? .....

9. At what stage is a program of works prepared?
10. Who prepares the program of works in your case?

.....

11. How do you prepare the program of works?

a) Manually ☐

b) Software ☐ Please state.

c) Others, please specify?

.....

12. For what purposes do you prepare a program of works?
13. i) Do you consider a program of works to be an important item in construction?

a) Yes ☐ b) No ☐

ii) Please explain your answer above? .....

.....

.....

14. Do you have any background training on the preparation of works? If Yes, please state?

.....

.....

15. In what circumstance(s) has the program of works ever proved to be important during your career as a contractor?

.....

.....

.....

Section C: Factors to Consider

16. What factors do you consider when preparing a program of works?

a) Complexity of project ☐

b) Critical activities ☐

c) Type of project involved ☐

d) Others, please specify?

.....

17. How often do you review the program of works?

a) Never ☐

b) At each and every stage ☐

c) After a problem arises ☐

d) Others, please specify?

.....

18. What is the type of the program of works in use in this project?

a) Resource oriented ☐

b) Time oriented ☐

19. What planning was/has been done for this project?

.....

.....

20. How was/has the program of works been planned for?

.....

21. Who evaluates the program of works after it has been prepared?

.....

22. What other factors do you consider when preparing a program of works?

.....

Section D: Deficiencies in Program of Works

23. Is the program of works an efficient tool for managing projects?

a) Yes ☐ b) No ☐

Briefly explain?.....

.....

24. How does the program of works aid in meeting construction timelines?

.....

.....

25. How does the program of works help you plan for the following?

a) Delays

.....

b) Disruptions

.....

.....

26. Does the program of works lead to delays and disruptions?

a) Yes ☐ b) No ☐

Briefly explain .....

.....

27. What shortcomings have you ever experienced through the program of works?

.....

28. How did these shortcomings impact on the project?

.....

.....

Section E: Causes of Deficiencies in Program of Works

29. The following table gives a list of causes of deficiencies in program of Works. Please tick the extent to which you agree with each of the causes.

	Very Great Extent	Great Extent	Not at all	Little Extent	Very little Extent
Poor Preparation					
Failure to update Programs of Works					
Inadequately updated programs					
Cost of Preparation					
Lack of understanding of scheduling techniques					

30. Do you think there are other factors that lead to deficiencies in the program of works? Please state them.

.....

.....

THANK YOU FOR YOUR PARTICIPATION

APPENDIX II

DATA ANALYSIS RESULTS - SPSS OUTPUTS

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	14	93.3	93.3	93.3
	Female	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

What is your Level Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary	1	6.7	6.7	6.7
	Tertiary/College	4	26.7	26.7	33.3
	University	10	66.7	66.7	100.0
	Total	15	100.0	100.0	

Do you have any training on Construction Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	12	80.0	80.0	80.0
	No	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

If yes, please indicate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Part of study in Architecture	2	13.3	13.3	13.3
	Unit in civil engineering	8	53.3	53.3	66.7
	Msc. Civil Engineering	1	6.7	6.7	73.3
	No Response	3	20.0	20.0	93.3
	Not Applicable	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Please indicate the awarding body/institution (for ii above

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	KNEC	4	26.7	26.7	26.7
	University	7	46.7	46.7	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

Are you a registered Contractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	11	73.3	73.3	73.3
	No	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

If yes, what category is your registration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Building	5	33.3	33.3	33.3
	Specialist Contractors	1	6.7	6.7	40.0
	Roads and other Civil Works	6	40.0	40.0	80.0
	No Response	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

If yes, what classification is your registration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NCA1	2	13.3	13.3	13.3
	NCA4	1	6.7	6.7	20.0
	NCA6	7	46.7	46.7	66.7
	NCA7	2	13.3	13.3	80.0
	No Response	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

If any other, please specify

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NCA 8	1	6.7	100.0	100.0
Missing	System	14	93.3		
Total		15	100.0		

What kind of project is this

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Maisonnette	2	13.3	13.3	13.3
	Bungalows	4	26.7	26.7	40.0
	Flats	9	60.0	60.0	100.0
	Total	15	100.0	100.0	

What is your title for the project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Contractor	5	33.3	33.3	33.3
	Project engineer	6	40.0	40.0	73.3
	Not Applicable	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

What is the scope of work for this project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full constrction works	9	60.0	60.0	60.0
	Skeleton of building, roofing, finihing	5	33.3	33.3	93.3
	No Response	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Does the Project have a work schedule

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	12	80.0	80.0	80.0
	No	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

If yes above, have you been adhering to it

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	53.3	53.3	53.3
	No	4	26.7	26.7	80.0
	No Response	1	6.7	6.7	86.7
	Not Applicable	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

If No, above, why not

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	delays in payment	3	20.0	20.0	20.0
	No Response	10	66.7	66.7	86.7
	Not Applicable	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

At what stage is a program of works prepared

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Project planning/before projects commence	15	100.0	100.0	100.0

Who prepares the program of works in your case

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The contractor	8	53.3	53.3	53.3
	Project engineer	4	26.7	26.7	80.0
	Clerk of works	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

How do you prepare the program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manually	4	26.7	26.7	26.7
	Software	11	73.3	73.3	100.0
	Total	15	100.0	100.0	

For what purposes do you prepare a program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	For work efficiency	10	66.7	66.7	66.7
	Capture important actors of the project	1	6.7	6.7	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

Do you consider a program of works to be an important item in construction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	100.0	100.0	100.0

Please explain your answer above

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helps planning stages of work, save tiomew and improve efficiency	15	100.0	100.0	100.0

Do you have any background training on the preparation of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	66.7	66.7	66.7
	No	5	33.3	33.3	100.0
	Total	15	100.0	100.0	

If yes, please state

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Basics	6	40.0	40.0	40.0
	Full knowledge	4	26.7	26.7	66.7
	No Response	5	33.3	33.3	100.0
	Total	15	100.0	100.0	

In what circumstance(s) has the program of works ever proved to be important during your career as a contractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helps alot in profitability, offer guidance for activities to be followed	8	53.3	53.3	53.3
	All projects, all the time	5	33.3	33.3	86.7
	No Response	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

What factors do you consider when preparing a program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Complexity of Projects	1	6.7	6.7	6.7
	Criical Activities	12	80.0	80.0	86.7
	Type of projects involved	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

How often do you review the program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	At each every stage	13	86.7	86.7	86.7
	After a prblem arises	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

What is the type of the program of works in use in this project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Resource oriented	2	13.3	13.3	13.3
	Time oriented	13	86.7	86.7	100.0
	Total	15	100.0	100.0	

What planning was/has been done for this project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every stage is allocated time, by graph illustartions	7	46.7	46.7	46.7
	Finances and time	4	26.7	26.7	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

How was/has the program of works been planned for

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	It must be prepared for every project	8	53.3	53.3	53.3
	No Response	7	46.7	46.7	100.0
	Total	15	100.0	100.0	

Who evaluates the program of works after it has been prepared

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Contractor	2	13.3	13.3	13.3
	Chief officer/ BOD/ Project manager	12	80.0	80.0	93.3
	site engineer	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

What other factors do you consider when preparing a program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Labour force	4	26.7	26.7	26.7
	finances	5	33.3	33.3	60.0
	No Response	4	26.7	26.7	86.7
	Not Applicable	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Is the program of works an efficient tool for managing projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	15	100.0	100.0	100.0

Briefly explain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helps manage projects within time allocated and helps in productivity	12	80.0	80.0	80.0
	No Response	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

How does the program of works aid in meeting construction timelines

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	By proper observations of the works, its agood tool	11	73.3	73.3	73.3
	No Response	3	20.0	20.0	93.3
	Not Applicable	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

How does the program of works help you plan for the following?Delays

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	You can adjust and change time for different stages, catch up with lost time	11	73.3	73.3	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

How does the program of works help you plan for the following? Disruptions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Identify sources of disruptions	9	60.0	60.0	60.0
	No Response	6	40.0	40.0	100.0
	Total	15	100.0	100.0	

Does the program of works lead to delays and disruptions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	6.7	6.7	6.7
	No	14	93.3	93.3	100.0
	Total	15	100.0	100.0	

Briefly explain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	With a good timeline its not easy for to the program of works to eiher disrup or delay works	10	66.7	66.7	66.7
	if not adhered to	1	6.7	6.7	73.3
	No Response	4	26.7	26.7	100.0
	Total	15	100.0	100.0	

What shortcomings have you ever experienced through the program of works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	6	40.0	40.0	40.0
	elements not captured in program of works	5	33.3	33.3	73.3
	No Response	2	13.3	13.3	86.7
	Not Applicable	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

How did these shortcomings impact on the project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	4	26.7	26.7	26.7
	led to delays	6	40.0	40.0	66.7
	No Response	4	26.7	26.7	93.3
	Not Applicable	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Poor Preparation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	5	33.3	33.3	33.3
	Great Extent	7	46.7	46.7	80.0
	Not at all	1	6.7	6.7	86.7
	Very Little Extent	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Failure to update Programs of Works

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	2	13.3	13.3	13.3
	Great Extent	7	46.7	46.7	60.0
	Little Extent	5	33.3	33.3	93.3
	Very Little Extent	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Inadequately updated programs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	1	6.7	6.7	6.7
	Great Extent	8	53.3	53.3	60.0
	Not at all	3	20.0	20.0	80.0
	Little Extent	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

Cost of Preparation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	1	6.7	6.7	6.7
	Great Extent	1	6.7	6.7	13.3
	Not at all	4	26.7	26.7	40.0
	Little Extent	4	26.7	26.7	66.7
	Very Little Extent	3	20.0	20.0	86.7
	No Response	2	13.3	13.3	100.0
	Total	15	100.0	100.0	

Lack of understanding of scheduling techniques

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Great Extent	5	33.3	33.3	33.3
	Great Extent	6	40.0	40.0	73.3
	Not at all	1	6.7	6.7	80.0
	Little Extent	2	13.3	13.3	93.3
	Very Little Extent	1	6.7	6.7	100.0
	Total	15	100.0	100.0	

Do you think there are other factors that lead to deficiencies in the program of works? Please state them.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	6	40.0	40.0	40.0
	Lack of skills	5	33.3	33.3	73.3
	not adhering to the program	1	6.7	6.7	80.0
	No Response	3	20.0	20.0	100.0
	Total	15	100.0	100.0	

APPENDIX III: NCA CONTRACTOR REGISTRATION CATEGORIES

Categories of Registration according to capability

1	Contractors (Buildings)		
		Category	**Value Limit (Kshs)**
	1.	NCA1	Unlimited
	2.	NCA2	Upto 500,000,000.00
	3.	NCA3	Upto 300,000,000.00
	4.	NCA4	Upto 200,000,000.00
	5.	NCA5	Upto 100,000,000.00
	6.	NCA6	Upto 50,000,000.00
	7.	NCA7	Upto 20,000,000.00
	8.	NCA8	Upto 10,000,000.00
2	**Specialist Contractors**		
		Category	**Value Limit (Kshs)**
	1.	NCA1	Unlimited
	2.	NCA2	Upto 250,000,000.00
	3.	NCA3	Upto 150,000,000.00
	4.	NCA4	Upto 100,000,000.00
	5.	NCA5	Upto 50,000,000.00
	6.	NCA6	Upto 20,000,000.00
	7.	NCA7	Upto 10,000,000.00
	8.	NCA8	Upto 5,000,000.00
3	**Roads and other Civil Works**		
		Category	**Value Limit (Kshs)**
	1.	NCA1	Unlimited
	2.	NCA2	Upto 750,000,000.00
	3.	NCA3	Upto 500,000,000.00
	4.	NCA4	Upto 300,000,000.00
	5.	NCA5	Upto 200,000,000.00
	6.	NCA6	Upto 100,000,000.00
	7.	NCA7	Upto 50,000,000.00
	8.	NCA8	Upto 20,000,000.00