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Influence of Scheduling Techniques on Project Performance of Registered Building Works Contractors in Nakuru County, Kenya

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Abstract:
The Project Management Institute (PMI) defines a schedule as a set of activities with start and finish dates. A schedule defines the work to be accomplished (what), the sequence of work (when), and the required resources (who). Therefore, the purpose of scheduling is to provide a road map for project execution, from inception to completion.Successful construction projects basically rely on successful practices of project management in regard to planning, implementation and cost, time and quality achievements. Therefore, the study sought to establish the influence of scheduling techniques on project performance of registered building works contractors in Nakuru County, Kenya. Specifically, the study sought to establish the influence of critical path method and Gantt chart on project performance of registered building works contractors in Nakuru County, Kenya. The study was anchored on the concept of resource dependence, theory of triple constraints and project life cycle model. A descriptive survey research design was adopted in the study targeting 572 building works contractors engaged in building works in Nakuru County, Kenya. Nassiuma's formula was used to derive the sample size of 85 respondents. Questionnaires were used to collect the primary data desirable for the study.Descriptive statistics involved the use of percentages, frequencies, measures of central tendencies (mean) and measures of dispersion (standard deviation). Inferential statistic involved the use of correlation analysis to establish the nature of the affiliation amongst variables at a generally accepted conventional significant level. The findings indicated that there exists a strong positive and significant relationship between critical path methods and project performance of registered building works contractors with a regression coefficient of 0.382. The findings also indicated that there exists a strong positive and significant relationship between Gantt chart techniques and project performance of registered building works contractors with a regression coefficient of 0.504. The study concluded that through critical path method project managers are able to accurately determine the timelines of various project activities and through Gantt charts project managers are able to track project outcome on time. The study recommended that critical path method should be used to enable project managers to accurately determine the timelines of various project activities. The researcher also recommended that Gantt charts should be used to enable project managers to track project outcome on time.

Keywords: Scheduling techniques, Gantt chart, Critical path method, project performance

1. Introduction

1.1. Background of the Study

The purpose of construction project management is to plan, coordinate and control the application of project objectives in the most effective way according to stakeholders' needs (Harris & McCaffer, 2013). It involves many processes and sub-processes and includes the definition of project scope, cost estimating, roles and responsibilities of the project team, project stakeholder management, as well as the utilization of planning and control methods and tools. These require knowledge of the fundamentals of project management in order to develop successful project plans and schedules (Heagney, 2011), Where there is a lack of knowledge, the application of project management concepts will result in incomplete project plans (or poor planning) and, hence, loss of project performance (Ahern, 2014).

The Project Management Institute (PMI) defines a schedule as a set of activities with start and finish dates. A schedule defines the work to be accomplished (what), the sequence of work (when), and the required resources (who). Therefore, the purpose of scheduling is to provide a road map for project execution, from inception to completion (PMI 2013).

According to Theodore (2009), a project Schedule is a written or graphical representation of the contractor's plan for completing a construction project that emphasizes the elements of time and sequence. The plan will typically identify the major work items (activities) and depict the sequence (logic) in which these work items will be constructed to complete the project. Project schedule is also an estimate of the time required to construct the project and is a valuable project control tool used to effectively manage construction projects. When it is used properly, it allows management to control and measure the pace of the work and provides the participants with the information to make timely decisions.

According to Alias (2014), successful construction projects basically rely on successful practices of project management in regard to planning, implementation and cost, time and quality achievements. In reality, however, there are shortcomings as is manifest in schedule deviations and cost overruns (Altoryman, 2014). Managing projects thoroughly requires a significant amount of time, skill, and finance. Project management has many attributes that make it interesting and demanding. Project managers focus to take an unclear event and make an absolute promise of delivery time to the owner as well as to the whole construction team and community (Blanc & Makovsek, 2016). Project management teams manage to do this within a specified time and a limited budget (Robinson & Richards, 2016). With this information, schedules help the project and business stay on time and under budget.

Scheduling is a primary tool used to manage projects, which is not nearly as significant as developing a mutual understanding of what the project is supposed to accomplish or construct (Heagney, 2015). A schedule technique is a project's timetable, consisting of sequenced activities and milestones that have to be delivered under a given deadline. Project scheduling is still a worthwhile practice. Construction businesses and the use of project schedules can measure results in business projects (Seboru, M.A. (2015). Schedules, in turn, show the timeline and possibility of being behind schedule and coming in over budget. Schedules act as a guide to make sure that the business project is on schedule and that the next scheduled task is on time.

Globally, relatively more comprehensive program of works offers the contractor a higher chance of excellence in the project delivery. From the literature reviewed Kursave (2016) observed that 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. Most contract documents do not have adequate provisions and sufficient emphasis for effective preparation and maintenance of contractors' construction programmes (Pickavance, 2015). 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 format with a requirement to update periodically a work schedule to reflect contract performance (Wickwire, 2017). 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 (2015) it is not uncommon for contractors to provide brief information 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 decide 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 endeavor 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.

In Nigeria, Olomolaiye (1998) as cited by Nyambura (2017), conducted a study on how construction workers spent a typical working day. The data was analyzed considering only the working hours and the results showed that, on average workers spent 55% of their working time (excluding official break times) on productive activities, 2.1% on supervision-related activities, 13% on extra break and 29.4% unproductively. The extra breaks consisted of early quits and late starts; clearly, a loss of 13% is considerable for a typical construction site. The observed supervision time particularly time spent taking instruction and inspection- varies depending on the type of work, available details such as drawings and also on the skill and knowledge of the operatives and can be considered unavoidable given a particular situation. One of the problems causing unproductive time was lack of materials which caused the greatest hindrance to operatives. Detailed analysis indicated lack of planning, in terms of sequencing and site planning as the main source of the problem.

Kaliba, Muya and Mumba (2009), conducted a study which aimed at determining the causes and effects of cost escalation and schedule delays in road construction projects in Zambia. Specifically, the study aimed to identify causes and effects of cost escalation and schedule delays in road construction projects. The study found out that bad or inclement weather due to heavy rains and floods, scope changes, environmental protection and mitigation costs, schedule delay, strikes, technical challenges, inflation and local government pressures were the major causes of cost escalation in Zambia's road construction projects. On the other hand, delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor super-vision, construction mistakes, poor coordination on site, changes in specifications and labour disputes and strikes were found to be the major causes of schedule delays in road construction projects.

Apolot *et al*, (2012), investigated the Causes of Delay and Cost Overrun in Uganda's Public Sector Construction Projects. Specifically, the study was conducted to identify the causes of delays and overruns and to rank them according to

their frequency, severity and importance. The findings showed that the five most important causes of delays in construction projects were changes to the scope of work, delayed payments, poor monitoring and control, the high cost of capital and political insecurity and instability. The study recommended for improvement in project management, a change from the traditional contract type to the design–build type and improved cash flow on the part of the client to reduce payment delays.

Studies by the Kenya National Bureau of Statistics (2012), observed that that up to 47.5 % of the roads projects done by the government of Kenya through the Kenya Urban Roads Authority, KURA, who got the funding from the Kenya Roads Board (KRB) between 2004 and 2013 were never been completed in time due to various reasons. For example, the road from Mwatate to Wundanyi (15.580kms) and the proposed Taveta bypass (11.965 kms), was delayed by almost 3 years than the actual planned completion time due to factors like contractual agreements and funding criteria between the Kenyan government and the Tanzanian government

According to Auma, (2014), in Kenya, there is evidence that the performance of the construction in Kenya is poor as time and cost performance of projects are to the extent that the majority of the projects initiated are likely to escalate with time, with a magnitude of over 50% and over 50% of the projects likely to escalate in cost with a magnitude of over 20%. Seboru, (2015), Investigated Factors Causing Delays in Road Construction Projects in Kenya. The objectives of this study were to document the range of identified causes of delay in completing road construction projects in Kenya; to document the most important causes of delay in road construction projects in Kenya; and to document identified differences in perception of contractors and consultants regarding causes of delay in delivering projects by the intended completion date. The study found out that the top five causes of project delays were delayed payment by client, slow decision making and bureaucracy in client organization, inadequate planning and scheduling, and rain. The researcher recommended that clients should improve their financial management systems so that they are able to pay contractors in a timely manner, Bureaucracy and red tape should be reduced in client organizations in order to speed up the slow decision making process, Efficient management of the construction process to reduce in incidences of claims and Contractors should prepare adequate plans and schedules which can also be used to minimize the effects of rain.

Mohamed (2017), conducted a study to examine the influence of time overruns in the implementation of County construction projects; the case of Lamu County, Kenya. The specific objectives were to determine the influence of political good-will in the implementation of County construction projects, assess the influence of budgetary allocations on the implementation of County construction projects, examine how organization structures within the county government influenced the implementation of County construction projects and to find out the extent to which contracts management influenced the implementation of County construction projects in Lamu county, Kenya. From the study findings, it was concluded that, politics and political goodwill had a significant influence on the rates of projects completion, the budgetary allocations from both the national and county governments had a significant influence on the implementation and completion of projects, county governance structures had a significant influence on the rates of projects completion and that contracts management significantly influences the rates at which projects are completed by counties.

Muchungu (2012), conducted a study on the contribution of human factors in the performance of construction projects in Kenya. The study focused on how human factors contributed to achievement of the construction project management goals of cost, time, quality, environmental sustainability and client satisfaction. The researcher found out that despite the high quality of training of consultants in the building industry in Kenya and regulation of the industry in major urban areas, construction projects do not always meet their goals. According to him, this was manifested by myriad projects that had cost overrun, delayed completion period and poor quality resulting to collapsed buildings in various parts of the country, high maintenance costs, dissatisfied clients and even buildings which were not functional.

1.1.1. Registered Building Works Contractors in Kenya

Contractors operating or willing to undertake construction operations in Kenya are required by law to register through the National Construction Authority (NCA), which is constituted under Act No. 41 of 2011 Laws of Kenya (G.O.K., 2011). The NCA is mandated to clear builders and contractors as a way of eliminating rogue contractors in Kenya and malpractices in building and construction. The Authority, which is tasked with the responsibility of inspecting construction and building projects around the country to ensure high quality of work and close projects posing health risks and collapse hazards, has provided the regulatory framework for registration and renewal of contractors (G.O.K., 2011). The NCA has published the National Construction Authority Regulations 2014, the Code of Conduct and Ethics for the Construction Industry, and the NCA Strategic Plan (2015-2020) to effectively regulate the construction industry in Kenya.

The Contractors registration establishment in Kenya has eight (8) distinct categories ranging from NCA1 (Highest) to NCA8 (Lowest) with most of the contractors doing more than one class of work. The main classes of work include Roads, Water, Building, Electrical and Mechanical. There are over 13,700 contractors registered by NCA with over 22,400 licenses in the above classes of work. Building works has the highest proportion of licensed contractors at 43% followed by Roads at 34%. Water and Electrical works have proportions of 10% and 9% respectively. Mechanical has a paltry 3%. The sector is dominated by small and medium enterprise contractors which account for a total of 79% with NCA5 11%, NCA6 22%, NCA7 31% and NCA8 15%. Large establishment contractors account for 21% with NCA4 13%, NCA3 4%, NCA2 2% and NCA1 3%. 71% of the construction firms are owned by men whilst 21% have joint ownership of both men and women. Women owned companies account for only 7%. (G.O.K., 2011)

1.2. Statement of the Problem

Successful construction projects basically rely on successful practices of project management in regard to planning, implementation and cost, time and quality achievements. Studies conducted by Auma (2014) and Muchungu

(2012) indicated that there is evidence that the performance of the construction in Kenya is poor as time and cost performance of projects are to the extent that the majority of the projects initiated are likely to escalate with time, with a magnitude of over 50% and over 50% of the projects likely to escalate incost with a magnitude of over 20%. Despite the high quality of training of consultants in the building industry in Kenya and regulation of the industry in major urban areas, construction projects do not always meet their goals. This is manifested by myriad projects that have cost overrun, delayed completion period and poor quality resulting to collapsed buildings in various parts of the country, high maintenance costs, dissatisfied clients and even buildings which are not functional which has remained as major challenge in the building construction industry in Kenya over time. It is against this background that this study sought to establish scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya.

1.3. Research Objective
In this section, the researcher outlined both the general and the specific objectives as outlined below;

1.3.1. General Objective
The general objective of the study was to establish the influence of scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya

1.3.2 Specific Objectives
- To establish the influence of critical path method on project performance of registered building works contractors in Nakuru County, Kenya
- To examine the influence of Gantt chart technique on project performance of registered building works contractors in Nakuru County, Kenya

1.4. Research Hypotheses
The study was based on the following hypotheses:
- Ho_1: Critical path method has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya
- Ho_2: Gantt chart has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya

1.5. Significant of the Study
This study will be beneficial to various stakeholders in the building construction industry. These will include the ministry of public works, National Construction Authority, County government of Nakuru. Investors in the construction industry and academicians. It is expected that the results and recommendations of the study will guide current practice for the relevant authorities like the Ministry of Public Works and National Construction Authority (NCA) on actions that need to be taken so as to ameliorate the performance rate of construction projects. Investors seeking to join or expand in the construction industry will be able to make informed evaluation as to what is driving the changes in scheduling techniques and thus be able to make sound decisions. Individuals seeking to own their own homes will also benefit in understanding the scheduling techniques that best suits their construction plan. Financing institutions will find this study useful in regard to scheduling techniques since this affects the long-term evolution of real estate financing. It will also add to the body of knowledge in existence in the construction field which will be beneficial to academicians by providing a basis for further research in the field. Thus, it will make a contribution to the literature on scheduling techniques and project performance of registered building works contractors.

1.6. Scope of the Study
This study sought to establish the influence of scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya. The study targeted 572 registered building works contractors. The study focused on two independent variables Critical Path Method and Gantt chart. The study was undertaken over a period of 6 months from December 2018 to May 2019.

1.7. Limitations of the Study
Some of the targeted respondents in the study had demanding schedules, thus they had time constraints in filling the questionnaire, however the drop and pick method of data collection was employed so that they filled the questionnaire at their own time. The study was also limited to access to information, as the respondents could fear exposing their business secrets to competitors and expressed reservations due to fear of the unknown regarding the study. To overcome these limitations the researcher used the introduction letter and research permit and further explained to the respondents that the study was only meant for academic purposes and that their information was confidential.

2. Literature Review
This chapter reviews the literature relevant to the current study with a critical focus on the influence of scheduling technique on project performance. It gives the theoretical review, conceptual framework, review of literature relevant to the study, empirical review, and critique of the existing literature, research gaps and the summary of reviewed

literature. By critically evaluating gaps in the previous research studies, this chapter provides information to support the study.

2.1. Theoretical Framework

A theory is a set of interrelated principles and definitions that present a systematic view of the phenomena by specifying relationships among variables with the purpose of explaining natural phenomena. Theoretical frameworks are explanations about the phenomena (Camp, 2016) and they provide the research with the lens to view the world clearly (Merriam, 2015). The study was guided by Resource Dependency Theory, Theory of Triple Constraints and Project Life Cycle Model.

2.1.1. Resource Dependence Theory

Resource Dependence Theory (RDT) originated in the 1970s by Jeffrey Pfeffer and Salancik (1970) and is based upon how the external resources of organizations affect the behavior of the organization. The theory is based upon the following tenets: Organizations are dependent on resources that ultimately originate from the environment of organizations; the environment to a considerable extent contains other organizations. The resources one organization needs are thus often in the hand of other organizations. In line with this study, registered building works contractors use resources which are in the hands of the shareholders. Similarly, communities in which projects are implemented depend on funds from the shareholders supporting them (Davis & Cobb, 2010). Resources are a basis of power; legally independent organizations can therefore be dependent on each other (Collins, 2011). The composition, influence, knowledge, motivations and actions of stakeholders are 'turbulent', meaning they differ for any given place and for any given time, with groups forming complex and ever-changing webs of relationships which are inherently uncertain.

In as much as organizations are inter-dependent, the theory of Resource Dependence needs a closer examination. Its weakness lies in its very assertions of dependence. With changing trends of financial uncertainties, there is need to lean towards other theories of uncertainties. According to this theory, organization depends on resources for their survival; therefore, for any organization to achieve sustainability, resources are indispensable. For construction projects to achieve sustainability, resources are important. These resources will come in the form of human resource therefore the need to involve all the stakeholders in the project for sustainability; other resources include land and finances (Davis & Cobb, 2010).

In this research, all the two independent variables are resource dependent and interdependent in nature. Resource uncertainties affect Critical Path Method and Gantt chart. All organizations are resource dependent in order to survive and achieve sustainability. As a result, this theory is very relevant to this study and will help understand influence of Critical Path Method and Gantt chart on project performance of registered building contractors in Nakuru County, Kenya.

2.1.2 Theory of Triple Constraints

The theory of triple constraints is rooted in the theory of constraints (TOC), first formulated by Eliyahu Goldratt in 1984. According to Dobson (2004) as cited by Rugenyiand Bwisa, (2016), the theory of the triple constraint states that the triple constraint is a triangle of time, cost and performance that bounds the universe within which every project must be accomplished. As shown in Figure 1.1
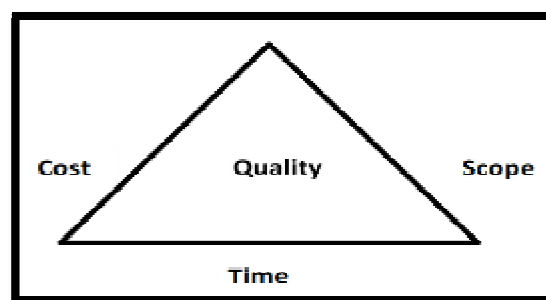

Figure 1: Triangle of Triple Constraints

Empirical studies by Wayngaad, Pretorius, and Pretorius, (2012), said that the triple constraint constitutes a balance of the three interdependent project elements of scope, time and cost as a function of the project higher purpose.According to them,the cause and effect of new or changing triple constraint requirements are constantly negotiated during all phases of a project. In addition, they said thatthe three key triple constraint relationships signify that at least one of the triple constraint variables must be constrained otherwise there is no baseline for planning, and at least one of the variables must have capacity for exploitation otherwise quality may be affected.

According to Mokoena, Pretorius and Van Wayngaad (2013), Scope is a term used to describe qualitative and quantitative components of a project to accomplish a project objective successfully. Based on the practical experience of the author, it is deduced that the scope of work has three components; quality, specifications and standards to be achieved. The element of the triple constraint is defined as the actual duration estimated for execution and completion of the scope of work. It has two components; scheduling and schedule control while the project cost is referred to resources that need to be applied or assigned to the project in order to accomplish the proposed scope of work.

The Triple Constraint is a model that helps managers know what trade-offs are going to work and what impact they'll have on other aspects of the project. By using a project management dashboard, a manager can keep sight of the project as it progresses (Baratta, 2006, cited by Rugenyi 2016). This particular research agreed with the view of Dobson (2004) of the triple constraint of project scope, cost and time since, as Wayngaad, Pretorius, & Pretorius (2012) evaluated, there is a general agreement that they comprise the key variables of the triple constraint. The theory is relevant to study in explaining the effect of various scheduling technique managing the key determinants of projects success which are scope, time and cost.

2.2. Empirical Review

This section looks at a review of literature concerning the specific objectives. This includes: to determine the influence of critical path method and Gantt chart on project performance of registered building works contractors.

2.2.1. Critical Path Method and Project Performance

Critical path method is a Project Network Analysis technique used to determine which sequence of activities (path) has the least amount of scheduling flexibility and therefore will most likely determine when the project can be completed (Theodore, 2009;

Olateju, 2011). A number of studies have been carried out to determine the relationship between critical path method and project performance. A study by Aliyu, (2012) assessed project management using Critical Path Method (CPM) in Nigeria. The specific objectives of the study included. The source of data was purely secondary. A visit was conducted to the project site, and physical contact was made with the project manager on site. The researcher noted that professionals and executors of public projects in Nigeria remained conscientiously to the Gantt chart. In order to address this problem of project planning, the CPM was applied to "construction of a complex building at Federal University of Technology, Yola." Their paper described a specific case study with real data and an application. The results showed the effectiveness of the CPM in, planning, scheduling, and organizing, coordinating, managing, and controlling of project time and cost.

A study by Trauner, *et al.* (2009), sought to identify the main time issues (delay factors) in major Norwegian construction projects and the recommended solutions. The methodology on which this paper was based included an intensive literature review, open questionnaires and unstructured interviews with practitioners. The findings pointed out the major weaknesses of this method as follows: firstly the impacted schedule did not show the project activities as they occurred, secondly the decision of placing which changes or impacts into the schedule was greatly subjective, and finally, and also most significantly, it did not reflect the dynamic nature of construction project and the critical path. The authors also added that some analysts liked this approach because of being simple and clean, however, this method was greatly inaccurate. According to the authors by using the first schedule, this method froze the critical path at the beginning of the project, thus the real changes in the critical path was not identified.

A study by Heravi and Seresht (2018) in South Korea sought to investigate the delay risk factors of the non-critical activities are identified and a new methodology is proposed for prioritizing the non-critical activities to improve the planning process of the construction projects. Prioritization of the non-critical activities enhances the project manager's vision toward the risks incorporated with using the float time of each individual activity due to the fact that multiple criteria need to be considered for prioritizing the non-critical activities. Finally, an algorithm was developed for application of the proposed methodology in the construction projects. (Heravi and Seresht, 2018)

2.2.2. Gantt Chart Technique and Project Performance

Gantt chart is a bar graph with time on the horizontal axis and resources on the vertical axis that is used as a project management tool (Wilson, 2016). A number of studies have been conducted to determine the influence of Gantt chart in project performance. A study by Joana *et al* (2012), sought to explore a classic tool in project management; the Gantt chart. The Gantt chart was developed in the early twentieth century, at the heart of Scientific Management; yet, the chart was used with very little adaptation across a wide range of types of projects. The authors analyzed the conceptual roots of the Gantt chart, its historical development and use, derived its engrained principles, and analyzed its implications to the management of projects.

In their conceptual paper, the authors questioned its universal and unreflective use. The findings revealed that while a Gantt chart can be useful to cope with some of the complicatedness of projects, and embraces the importance of time and timing, it is based on principles that are not valid to all projects. The consequence is a propagation of a management approach that does not explicitly cope with complexity, ambiguity, uncertainty and change. In that respect, the Gantt chart fails to acknowledge insights from years of organization theory research and project management research with a firm grounding in contingency theory.

A study by Nyambura (2017), sought to report the findings of a survey designed to capture the real world experiences of people active in project management (PM) in Australia, Canada and the United Kingdom (UK); determine the extent to which those involved in the management of projects make use of the methods and techniques that were available; and discover how effective the methods and techniques were felt to be. A questionnaire comprising 24 questions with a mixture of yes/no, Likert-scale, multiple choice and open questions was developed. These were designed so that the data gathered could be compared with the results of a similar survey conducted in the UK a decade ago. Professional networks and direct e-mails were used to distribute the survey electronically to potential respondents who were actively involved in PM in the three countries. A total of 150 responses were used in the analysis, 50 from each country. The results showed that there were many areas where the experiences, practices and views were similar across all three countries and

were comparable to the earlier UK survey. However, as was often the case, it was perhaps the differences that were of most interest and these were commented upon throughout the paper.

Vignet (2009), conducted a study on the embodiment relating generally to enterprise resource and program management, and more particularly to a method and system for Java Gantt/Bar chart rendering in an enterprise project portfolio management environment. The study adopted cross sectional research design. A system for Java Gantt/bar chart rendering included an extractor to receive project data, a table generator to generate a project table suitable for representing the project data, and a dynamic page component to generate a chart image utilizing the project table, the chart being one of a Gantt chart and a bar chart. The table generator was to receive a data model and a table model to generate the project table.

2.2.3. Project Performance

Project performance is the measures of successful completion of projects as per the budgeted cost, time and quality. Monitoring and controlling the progress of project activities are important processes for managers, because it allows them to identify the limits which may compromise the project progress, comparing the current situation with elaborate planning and consequently assisting the managers to balance the project activities and put them according to the initial plan (Grigore *et al,* 2018)

Neamat (2017) conducted a study on factors affecting project performance in Kurdistan Region of Iraq. The study investigated for 63 factors of consultants and constructors' viewpoints. A total of 120 questionnaires were distributed to 25 owners, 35 consultants and 60 contractors. The findings revealed that project delay occurs due to shortage and closure of materials; the labors' availability in their work according to project duration; managing of projects and providing the skills of leadership; Alteration in prices of materials; highly qualified and expert persons need. The findings also revealed that cash flow is significant since it measures the performance cost in every level of construction work. The researcher recommended that constructing organizations should reach their strong purpose in their production. Perfect methods and approaches must be recognized for controlling the impact of political and economic conditions.

Kihoro and Waiganjo (2015) conducted a study on factors affecting performance of projects in the construction industry in Kenya. This study focused on three aspects of performance namely timely completion, cost management as well as quality. A descriptive survey design was used. Quantitative techniques were used for data collection as well as data analysis. Data collection instruments that were used were close ended questionnaires. SPSS statistical tool was used for data analysis. The findings indicated that there was a strong positive relationship between project planning, stakeholder management, competence of project team and performance of the project. The study recommended the use of multi criteria analysis during planning as well proper relationship management among all the stakeholders in the project.

Melba, Dhanya and Ramasamy (2015) conducted a study on factors affecting the performance of the construction projects. The questionnaire was distributed in Chennai, Kerala and Bangalore industries. The questionnaires were distributed to contractors, owners and consultants. Mainly the regions covered were Chennai, Kerala and Bangalore. The analysis of the response was done using the SPSS software. From the findings the top five factors affecting the performance of projects were identified as increase in material cost, inadequate supply of labour, incorrect planning, wrong method of estimation, and poor financial control on site. They recommended that consultants should focus more on design cost by using multi criteria analysis and most economical criteria should be adopted so as to improve their performance and also to increase owner's satisfaction. Contractors should be aware of the business environment risks in their cost estimation. Enough contingency allowances should be there to guard against the increasing material prices.

Nyangwara and Datche (2015) conducted a study on factors affecting the performance of construction projects in the Coastal Region of Kenya. The study adopted a cross sectional survey design. The targeted population for the study was Consultants, Contractors and Owners of construction projects from the construction industry sector in Coastal region of Kenya. Questionnaires were used as the main data collection instrument. The most important factors agreed by the owners, consultants and contractors were: average delay because of closures and materials shortage; availability of resources as planned through project duration; leadership skills for project manager; escalation of material prices; availability of personals with high experience and qualification; and quality of equipment and raw materials in project. They recommended that construction companies should develop human resources in the organization through proper and continuous training programs about construction projects performance.

2.3. Conceptual Framework

According to Shields and Rangarajan (2013), A conceptual framework is the way ideas are organized to achieve a research projects purpose as illustrated in Figure 2.1
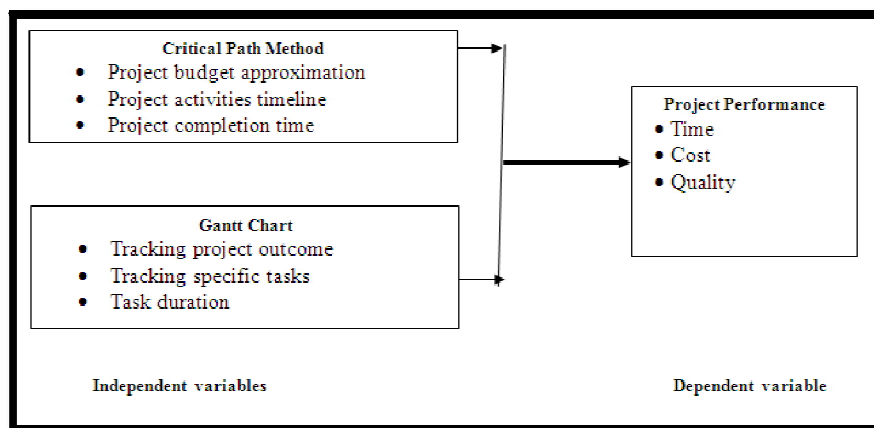
Figure 2: Conceptual Framework

2.4. Review of Literature on Variables

Under this section the study will review the variables based on the works of other scholars;

2.4.1. Critical Path Method (CPM)

A Critical Path Method (CPM) schedule is an arrow diagram or logic network of the work activities that graphically or visually represents the construction plan. CPM contains all of the Project work items and connects or links those work activities to one another according to their planned sequence. CPM schedule strength lies in the ability to identify the critical path or the longest path of work through the network which predicts the earliest date that the project can be completed. It's a Project Network Analysis technique used to determine which sequence of activities (path) has the least amount of scheduling flexibility and therefore will most likely determine when the project can be completed. CPM is a dynamic modeling tool that can identify issues and problems before they arise (Theodore, 2009; Olateju, 2011).

Critical path is the sequence of activities which add up to the longest overall duration. Critical Path Method is the shortest time possible to complete the project (Bokor, 2014). Any delay of an activity on the critical path directly impacts the planned project completion date. A project can have several, parallel or near critical paths. CPM closely follows the deliberative action model, since it attempts to create a virtual, equivalent and complete model of the project to perform. The Critical Path is the longest path through the project, and that determines the project 's duration. In a CPM network, events are represented by circles and activities are showed as arrows. CPM is capable of storing logic that has been created, and in consequence allows easy modifications to the original plan (Bokor, 2014). CPM is a very important and effective technique in the project management activities and hence should necessarily be incorporated in the project management software packages available for project management activities. Critical Path Method is a powerful tool for planning and management of all type of projects. It provides a precise mathematical approach for planning, scheduling and control and allows ready evaluation and comparison of alternative work programmes, construction methods and types of equipment by changing individual activity durations, resources or relationships between activities (Jayawardena, 2016).
When used properly, CPM forces the project team to break down the project into discrete activities, estimate the durations for each of the activities, and think through the possible and preferable sequencing of the activities. This process forces the team to address critical questions that might not otherwise be considered. A CPM schedule should serve as the basis for a detailed plan of immediate tasks such as specifying the rooms to finish next week. These tasks can be developed and controlled by the field management in parallel to the official CPM schedule (Jayawardena, 2016).

Critical path and activity float are an excellent tool for controlling the project during execution. In order to qualify for this category, the project schedule must cover all of the core project phases and be based on CPM techniques. The schedule network should have a discernable critical path and should avoid excessive activity float. All activities in the schedule should be tied into the network, and the use of activity constraints should be limited. The level of detail can vary depending on the size and complexity of the project; but the entire project needs to be broken down into specific activities and a critical path analysis done. The Critical Path Method (CPM) is widely used in the construction industry to create the formal work plan for a project. Many owners and government agencies mandate its use by project contractors as a requisite for disbursing the first progress payment (Loulakis & McLaughlin, 2016).

The drawbacks of CPM are visible at execution time. Natural variations in the assumptions made about productivity, resources, weather and similar factors make inevitable that the plan becomes increasingly removed from the actual circumstances in the field. CPM schedules tend to be imposed on the field management. This is a natural fallout of the Deliberative Action model, since the development and execution of the plan are considered as separate issues. The primary role of foremen and other field personnel is the implementation of the plan, not its development. As a result of attempting to be comprehensive, a CPM schedule is too detailed for activities in the far future and too broad for the management needs for the near future (Korman, 2014).

2.4.2. Gantt chart Technique

Basically, the Gantt chart is a bar graph with time on the horizontal axis and resources on the vertical axis (Wilson, 2016). The chart has the advantages of easy to prepare, easy to interpret and understand. Compare to most planning tools,

the Gantt chart is a very good communicative tool, especially in the industry where most of the artisans are not highly educated. In view of this it is the most widespread way of displaying project plans (Bokor, 2014). In spite of these advantages the Gantt chart has some limitations. First, relationships or logic between activities cannot be shown on the chart. Also, the effect on the schedule is difficult to determine. Gantt concentrated his attention on the development of a method of charting which would show a comparison between performance and promises. Several years previous to this time, he had used a chart on which the work for machines was "laid out" according to the time required to do it. The Gantt Progress Chart, as developed from this early form, was found to help in the making of definite plans and to be highly effective in getting those plans executed. The rate at which the work goes forward is continuously compared with the advance of time, which induces action to accelerate or retard that rate. These charts are not static records of the past they deal with the present and future and their only connection with the past is with respect to its effect upon the future. (Clark, 2015).

The tool was well established and used for general production planning in the 1920s ignoring its use in managing projects (Wilson, 2016). Though Gantt chart was not mainly used in project management it was until the time of Koepke (1941) when project-based Gantt chart was illustrated. After this Gantt chart has been frequently used in project management, a Gantt chart provides a graphical illustration of a schedule that helps to plan, coordinate and track specific tasks in a project. Gantt charts are useful for monitoring project progress. One can track the outcome on time enabling correction where necessary to avoid mistakes and bring the project to path (Grigore *et al,* 2018). This is possible due to the graphical presentation of the activities. Projects management is viewed at small manageable items which can easily be visualized (Freeman &Beale, 2015), parallel processes discovered, time for each determined and tracked.

Other Benefits of using this tool is in the way it clearly illustrate the project status, where it can be adjusted frequently to reflect the actual status of project tasks, it also helps manage the temporal dependencies between tasks, it keep users on track enabling them to think clearly about what must be done to accomplish their goal (Waihumbu, 2015). According to Rahman (2017) of Malaysia, for a nuclear plant to be completed on time and budget given the working team should be given full authority since that the project involves hundreds or thousands of tasks, Gantt chart will help in avoiding confusion. Therefore, he proposes the use of Gantt chart among other project planning tools. From above discussion it is clear that this tool is good for managing projects effectively the challenge is the capacity of operation.

Geraldi (2014), explored a classic tool in project management, which for some has become almost synonymous with project management. The Gantt chart was developed in the early twentieth century, at the heart of Scientific Management; yet, the chart is used with very little adaptation across a wide range of types of projects. The author questions its universal and unreflective use. He specifically analyzed the conceptual roots of the Gantt chart, its historical development and use, derive its engrained principles, and analyze its implications to the management of projects. The findings of the study indicated that while a Gantt chart can be useful to cope with some of the "complicatedness" of projects, and embraces the importance of time and timing, it is based on principles that are not valid to all projects. The consequence is a propagation of a management approach that does not explicitly cope with complexity, ambiguity, uncertainty and change. In that respect, the Gantt chart fails to acknowledge insights from years of organization theory research and project management research with a firm grounding in contingency theory.

While investigating the effectiveness of using the Gantt charts as a solution to project delays Nyambura (2017), particularly sought to find out the causes of delay, evaluate the effects of delays, to know the effectiveness of using Gantt charts as a solution to project delays and the extent to which Gantt charts have been used in Kenya. Data was collected by the use of questionnaires which were administered to contractors whose total target population in Nairobi County was 2179, the sample size was 70 contractors. These were supplemented by secondary sources of data. Data from these sources was then statistically analyzed and presented in a graphical form.

Research findings indicated that the use of Gantt charts had a significant influence on the project completion time. The main reason behind this was that the contractors who used Gantt charts noted a difference in time with those projects that they did not use Gantt charts. The study also found out that Gantt charts were used primarily to provide schedule and resource data to upper management, allow for better control of financial and human resources, that Gantt charts as a project management tool and technique improved customer service and that Gantt charts ensured better internal control.

2.5. Empirical Review

This section looks at a review of literature concerning the specific objectives. This includes: to determine the influence of critical path method and Gantt chart on project performance of registered building works contractors.

2.5.1. Critical Path Method and Project Performance

Critical path method is a Project Network Analysis technique used to determine which sequence of activities (path) has the least amount of scheduling flexibility and therefore will most likely determine when the project can be completed (Theodore, 2009;

Olateju, 2011). A number of studies have been carried out to determine the relationship between critical path method and project performance. A study by Aliyu, (2012) assessed project management using Critical Path Method (CPM) in Nigeria. The specific objectives of the study included. The source of data was purely secondary. A visit was conducted to the project site, and physical contact was made with the project manager on site. The researcher noted that professionals and executors of public projects in Nigeria remained conscientiously to the Gantt chart. In order to address this problem of project planning, the CPM was applied to "construction of a complex building at Federal University of Technology, Yola."

Their paper described a specific case study with real data and an application. The results showed the effectiveness of the CPM in, planning, scheduling, and organizing, coordinating, managing, and controlling of project time and cost.

A study by Trauner, *et al.* (2009), sought to identify the main time issues (delay factors) in major Norwegian construction projects and the recommended solutions. The methodology on which this paper was based included an intensive literature review, open questionnaires and unstructured interviews with practitioners. The findings pointed out the major weaknesses of this method as follows: firstly the impacted schedule did not show the project activities as they occurred, secondly the decision of placing which changes or impacts into the schedule was greatly subjective, and finally, and also most significantly, it did not reflect the dynamic nature of construction project and the critical path. The authors also added that some analysts liked this approach because of being simple and clean, however, this method was greatly inaccurate. According to the authors by using the first schedule, this method froze the critical path at the beginning of the project, thus the real changes in the critical path was not identified.

A study by Heravi and Seresht (2018) in South Korea sought to investigate the delay risk factors of the non-critical activities are identified and a new methodology is proposed for prioritizing the non-critical activities to improve the planning process of the construction projects. Prioritization of the non-critical activities enhances the project manager's vision toward the risks incorporated with using the float time of each individual activity due to the fact that multiple criteria need to be considered for prioritizing the non-critical activities. Finally, an algorithm was developed for application of the proposed methodology in the construction projects. (Heravi and Seresht, 2018).

2.5.2. Gantt Chart Technique and Project Performance

Gantt chart is a bar graph with time on the horizontal axis and resources on the vertical axis that is used as a project management tool (Wilson, 2016). A number of studies have been conducted to determine the influence of Gantt chart in project performance. A study by Joana *et al* (2012), sought to explore a classic tool in project management; the Gantt chart. The Gantt chart was developed in the early twentieth century, at the heart of Scientific Management; yet, the chart was used with very little adaptation across a wide range of types of projects. The authors analyzed the conceptual roots of the Gantt chart, its historical development and use, derived its engrained principles, and analyzed its implications to the management of projects.

In their conceptual paper, the authors questioned its universal and unreflective use. The findings revealed that while a Gantt chart can be useful to cope with some of the complicatedness of projects, and embraces the importance of time and timing, it is based on principles that are not valid to all projects. The consequence is a propagation of a management approach that does not explicitly cope with complexity, ambiguity, uncertainty and change. In that respect, the Gantt chart fails to acknowledge insights from years of organization theory research and project management research with a firm grounding in contingency theory.

A study by Nyambura (2017), sought to report the findings of a survey designed to capture the real world experiences of people active in project management (PM) in Australia, Canada and the United Kingdom (UK); determine the extent to which those involved in the management of projects make use of the methods and techniques that were available; and discover how effective the methods and techniques were felt to be. A questionnaire comprising 24 questions with a mixture of yes/no, Likert-scale, multiple choice and open questions was developed. These were designed so that the data gathered could be compared with the results of a similar survey conducted in the UK a decade ago. Professional networks and direct e-mails were used to distribute the survey electronically to potential respondents who were actively involved in PM in the three countries. A total of 150 responses were used in the analysis, 50 from each country. The results showed that there were many areas where the experiences, practices and views were similar across all three countries and were comparable to the earlier UK survey. However, as was often the case, it was perhaps the differences that were of most interest and these were commented upon throughout the paper.

Vignet (2009), conducted a study on the embodiment relating generally to enterprise resource and program management, and more particularly to a method and system for Java Gantt/Bar chart rendering in an enterprise project portfolio management environment. The study adopted cross sectional research design. A system for Java Gantt/bar chart rendering included an extractor to receive project data, a table generator to generate a project table suitable for representing the project data, and a dynamic page component to generate a chart image utilizing the project table, the chart being one of a Gantt chart and a bar chart. The table generator was to receive a data model and a table model to generate the project table.

2.6. Critiques of the Existing Literature

Critical path method is a Project Network Analysis technique used to determine which sequence of activities (path) has the least amount of scheduling flexibility and therefore will most likely determine when the project can be completed. A study carried out by Aliyu (2012) that applied CPM Method on the project found that: If all activities were carried out at their normal time, then project would be completed in forty-one (41) weeks and that if each and every activity was executed at its crash time, then, the complex building was to be completed in thirty-two (32) weeks. The cost of the project was one hundred and eighty- eight million Naira. There was a substantial saving in project time and cost to the tune of nine (9) weeks that was 22 per cent of time and forty- seven million; six hundred and eighty thousand Naira, which represented 25.36 percent of the cost. Two methods that were used in the analysis of data. One enumerative method and the other was mathematical programming method. The methods are disadvantageous since enumerative method has the disadvantage that data may become out of date once it's collected. Also, mathematical programming method is subject to disadvantage that the relationships representing the objective as also the resource limitation

considerations, represented by the objective function and the constraint equations or inequalities, respectively must be linear in nature, which is not possible.

A study by Heravi and Sorest (2018) in South Korea sought to investigate the delay risk factors of the non-critical activities are identified and a new methodology was proposed for prioritizing the non-critical activities to improve the planning process of the construction projects. The study used a e quantitative research design. However, the quantitative research design used might be an improper representation of the target population which might also hinder the researcher from achieving its desired aims and objectives. Despite of applying appropriate sampling plan representation of the subjects is dependent on the probability distribution of observed data. Gantt chart is a bar graph with time on the horizontal axis and resources on the vertical axis that is used as a project management tool (Wilson, 2016). While exploring a classic tool in project management, Joana, *et al* (2012) concluded that Gantt chart can be useful in coping with some of the complicatedness of projects, embracing the importance of time and timing and is based on principles that are not valid to all projects. The study employed longitudinal data which faces the challenge that it is not easy to control the impact of unobserved heterogeneity, represented by the incidental parameters.

Vignet, (2009), conducted a study on the embodiment relating generally to enterprise resource and program management, and more particularly to a method and system for Java Gantt/Bar chart rendering in an enterprise project portfolio management environment. The study concluded that in a web-based environment, graphics (e.g., a graph or a chart) is often rendered to a user utilizing an applet (e.g., a Java applet), which may be run within an Internet browser. However, a Java applet may be resource intensive. It may require loading a number of data and, depending on a client machine; there may be a considerable delay in rendering the graph. Thus, there is a need for a method of rendering graphics, such as, for example, a bar chart or a Gantt chart, which is independent of browser Java applets and that may exhibit enhanced performance. However, the study was cross sectional and thus it does not help determine cause and effect and findings can be flawed or skewed if there is a conflict of interest with the funding source.

2.7. Research Gaps

Aliyu, (2012) from the research work that applied CPM Method on the project found the following results: If all activities were carried out at their normal time, then project would be completed in forty-one (41) weeks. One enumerative method and the other was mathematical programming method. The methods were disadvantageous since enumerative method has the disadvantage that data may become out of date once it's collected. Joana, *et al* (2012) while exploring a classic tool in project management, which for some has become almost synonymous with project management: the Gantt chart. The study employed longitudinal data which faces the challenge that it is not easy to control the impact of unobserved heterogeneity, represented by the incidental parameters.

Vignet, (2009), conducted a study on the embodiment relating generally to enterprise resource and program management, and more particularly to a method and system for Java Gantt/Bar chart rendering in an enterprise project portfolio management environment. The study employed longitudinal data which faces the challenge that it is not easy to control the impact of unobserved heterogeneity, represented by the incidental parameters. Thus, the present study will employ descriptive research design to bridge this gap.

A study by Joana *et al* (2012), sought to explore a classic tool in project management; the Gantt chart. The Gantt chart was developed in the early twentieth century, at the heart of Scientific Management; yet, the chart was used with very little adaptation across a wide range of types of projects. The study employed longitudinal data which faces the challenge that it is not easy to control the impact of unobserved heterogeneity, represented by the incidental parameters. Thus, the present study employed, a descriptive research design to bridge this gap.

Kibui (2016), conducted a study that sought to examine the influence of application of project management tools on project performance. Specifically, the study was sought to establish the effects of Gantt charts; the influence of work breakdown structure and the effects of network analysis on project performance of real estate projects within Nairobi County. The study adopted census sampling technique which has the limitation that data may become out-of-date once it is collected. The present study adopted stratified random sampling which is ideal for the respondents as it has the characteristic of providing each member of the target population in their strata an equal chance of being included in the study while at the same time keeping the size manageable.

Nyangwara and Datche (2015) carried out a study on the factors affecting the performance of construction projects in the Coastal Region of Kenya. The construction owners, consultants and contractors agreed that on average delays were due to closures and materials shortage; availability of resources as planned through project duration; leadership skills for project manager; escalation of material prices; availability of personals with high experience and qualification; and quality of equipment and raw materials in project. The study failed to address the influence of scheduling techniques on project performance a gap the present study sought to fill.

Kihoro and Waiganjo (2015) carried out a study on factors affecting performance of projects in the construction industry in Kenya. This study focused on three aspects of performance namely timely completion, cost management as well as quality was used for data analysis. The findings indicated that there was a strong positive relationship between project planning, stakeholder management, competence of project team and performance of the project. The study recommended the use of multi criteria analysis during planning as well proper relationship management among all the stakeholders in the project. The study failed to address the influence of scheduling techniques on project performance a gap the current study will address. Melba, Dhanya and Ramasamy (2015) and Neamat (2017) conducted a study on factors affecting the performance of the construction projects. None of them focused on the influence scheduling techniques on project performance a gap the current study will fill.

3. Research Methodology

3.1. Introduction

This chapter gives detailed information on research methods, and the research design that were used in carrying out the study. It gives details on the target population, sampling frame, sample size and sampling technique, data collection instrument, data collection procedure, pilot test and data analysis and presentation.

3.2. Research Design

Research design is the arrangement for collection and analysis of data in a manner that aims to combine the relevant stages of the research study. The study used descriptive survey research design. This type of design is appropriate for gathering information, summarizing, presenting and interpreting it for the purpose of clarification (Orodho & Njeru 2004) as cited by Muchelule (2018). According to Orodho (2005) as cited by Obwocha and Wanyoike (2019), descriptive survey research design can generate accurate information for large number of people over a wide area using a small sample. It is used to explore relationships between variables and allows generalizations across populations Since this study sought to obtain descriptive and self-reported information on the influence of scheduling technique on project performance of registered building works contractors inNakuru County, Kenya, the descriptive research design enabled the researcher to expose the respondents to a set of standardized questions to allow comparison.

3.3. Target Population

According to Mugenda and Mugenda (2003), as cited by Kibaara et al (2011), a target population is that population to which the person conducting the research wants to generalize the outcomes of the study. A population is referred as a whole collection of entities about which the researcher wishes to make a conclusion based on evidence and reasoning (Stillwell and Clarke, 2011). According to the National Construction Authority, there were 572 registered building works contractors based in Nakuru County, Kenya as of March 2019. This formed the target population classified as shown in Table 1.

Category	Capability (Kshs)	No. of Registered Contractors	Percentage (%)
NCA 1	Unlimited Amount	4	0.7
NCA 2	Up to 500,000.00	9	1.5
NCA 3	Up to 300,000.00	11	1.9
NCA 4	Up to 200,000.00	39	6.8
NCA 5	Up to 100,000.00	58	10
NCA 6	Up to 50,000.00	83	14.5
NCA 7	Up to 20,000.00	118	20.6
NCA 8	Up to 10,000.00	250	44
Total		572	100

Table 1: Classification of Registered Building Works Contractors in Nakuru County, Kenya

3.4. Sampling Frame

The sample is the subset of the population and contains elements with similar characteristics to the population (Kombo & Tromp, 2009). A sampling frame is the source material or device from which a sample is drawn. It is a list of all those within a population who can be sampled. For this study, the sample was drawn fromregistered building works contractors based in Nakuru County, Kenya. The major focus of this study was on Senior Managers and Construction Supervisors working on registered building works contractors inNakuru County, Kenya as they were the ones involved in top management and decision making.

3.5. Sample Size and Sampling Technique

Sampling has been described as the process of selecting a representative number of items out of the target population (Orodho, 2005) as cited by Muchelule (2018).

3.5.1. Sample Size

A sample size is the number of units that are chosen from which data were gathered. The sample of the study was 85 Senior Managers and Construction Supervisors working on registered building works contractors inNakuru County, Kenya.

3.5.2. Sampling Technique

Sampling technique is the process of selecting a sample size. Since the target population of this study is sufficiently large to warrant to use of random sampling methods. The study adopted Nassiuma's (2009) formula to calculate the size of the sample for registered building works contractors. The formula to scientifically derive the sample from the target population is illustrated below:

$$n = \frac{NC^2}{C^2 + (N-1)e^2}$$

Where

n = sample size

N = size of target population

C = coefficient of variation (0.5)

e = error margin (0.05)

Substituting these values in the equation, estimated sample size (n) was:

n = 572(0.5)2 / (0.52+ (572-1)0.052)

n = 85 respondents

Thus, based on this formula, the sample size for the study was 85 with a coefficient of variation of 0.5 and error margin of 0.05

In the second stage, the study used stratified random sampling in order to obtain the required sample size. Stratified random sampling is also ideal for the other respondents as it has the characteristic of providing each member of the target population in their strata an equal chance of being included in the study while at the same time keeping the size manageable (Kothari, 2004) as cited by Hassan (2017). The of contractors in each category was divided by the total number of contractors then multiplied by the sample size of 85 to get the sample size of registered building works contractors per each category. The sample size was then allocated into various categories according to their relative sizes in the target population as shown the sampling frame Table 2. The names of registered building works contactors were put in pieces of paper for each category and the randomly picked.

Stratum			
	Number	Percentage of Population (%)	Sample size for each category
NCA 1	4	0.7	1
NCA 2	9	1.5	1
NCA 3	11	1.9	2
NCA 4	39	6.8	6
NCA 5	58	10	9
NCA 6	83	14.5	12
NCA 7	118	20.6	18
NCA 8	250	44	36
Total	572	100	85

Table 2: Sample Size for Each Category of Nakuru County's Registered Building Works Contractors

3.6. Data Collection Instrument

A questionnaire was used to collect the primary data desirable for the study. According to Jankowicz, (2015) questionnaires are any written tools that present respondents with questions or statements to which they are expected to give respond to in writings or selected from the answers given (Jankowicz, 2015). The questionnaire contained structured questions which were the questions that the researcher had given the respondents the choices of the answers that the respondents can answer. The design of the questionnaire was based on a multiple-item measurement scale. A five-point Likert Data was employed, using a list of response categories ranging from strongly agree to strongly disagree where 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree and 1=Strongly Disagree. The questionnaire was divided into four sections that is Part A which had the background information and parts B, C D which had the research variables. There are several advantages associated with the use of the questionnaire and which informs its usage in this study. These advantages include ease of distribution and data collection, ease of data analysis, standardization of the questions and cost efficiency.

3.7. Data Collection Procedure

The researcher first sought permission from the Jomo Kenyatta University to go out and collect data in form of introduction letter. After being granted the permission, the researcher then applied for authorization from National Commission for Science, Technology and Innovations (NACOSTI) to collect data from registered building contractors. In both the introduction letter from the university and research permit from NACOSTI that clearly outlined the name of the researcher and the purpose for the study. With both the letter, the researcher proceeded to visit the registered building works contractors in Nakuru County, Kenya for introduction.

During the introductory visit, the researcher informed the senior manager in-charge of the proposed study and sought for data collection appointment. On the scheduled dates, the researcher visited the respondents at their respective offices with the printed questions for distribution. The researcher then issued the questionnaires to the study respondents and left them to answer in researchers' absence and at respondent's free time. The researcher then returned to collect the questionnaires after two weeks. This time allocated for the respondents to fill in the questionnaires is meant to improve the response rate which is desired in this study since the sample size is small. This method of questionnaire distribution and collection is called Drop-Off and Pick-Up.

3.8. Pilot Test

Pilot survey is a small-scale replica and rehearsal of the main study. It assists in determining the suitability and ease of use of the research instruments and the operational aspects of administering the questionnaires. The purpose of a pilot test is to discover possible weaknesses, inadequacies, ambiguities and problems in any aspect of the research process. The pilot study was carried in Kisii County to assess the effectiveness of the data collection instruments before venturing fully into data collection. This consisted 10 building contractors representing 10% of the sample size. Adjustments to the questions and other shortcomings found in the questions were corrected. The pilot test results are discussed below;

3.8.1. Reliability Test

To test reliability the study employed the internal consistency method which was a correlation method that measures the reliability of alternate items in the questionnaire based on responses from the pilot study (Kothari, 2003) as cited by Gitahi (2015). The results from the pilot study were subjected to the Cronbach's reliability test for internal consistency. Cronbach's Alpha was calculated and used as a measure of internal consistency. It measures how well a set of variables or items measure a single one-dimensional aspect of an individual. According to Fraenkel & Wallen (2000) as cited by Eisinga, Grotenhuis and Pelzer (2013), a Cronbach reliability coefficient $\alpha = 0.70$ or more indicates that the instrument is highly reliable and, therefore, usable for the study. Subsequently, modifications, additional questions and any shortcomings that were found in the questions will be corrected at this stage.

Variable	Number of Items	Cronbach's Alpha
Critical Path Method	5	0.721
Gantt Chart	6	0.814
Project Performance	5	0.765

Table 3: Reliability Statistics

3.8.2. Validity Test

Validity and reliability were established for standardization of the research instruments used in the study. The study opted for the content validity method of instrument validation. Content validity which is sometimes called logical or rational validity and face validity - which is personal judgment on the respondent's capability in understanding the concepts of the instrument and whether it addresses the research problem of the research instruments, was established in order to make sure that they reflect the concepts of project schedules in the construction industry. First, the researcher went through the instruments and compares them with the set objectives to ensure that they contain all the information to answer the set of questions and address the objectives. Secondly, expert judgment of the research supervisor was used to test the validity of the research instruments.

3.9. Data Analysis and Presentation

Data analysis is the procedure of assembling into order structuring coming up with the meaning to the mass of the information gathered (Cooper & Schindler, 2003) as cited by Luka (2016). Data analysis comprises of cutting the acquired information into a manageable size, coming up with summaries, looking for patterns and applying statistical techniques. The data that was gathered in this study was quantitative in nature. Qualitative data was analysed by utilization of Statistical Package for Social Sciences (SPSS). Descriptive and inferential statistics was employed in the study. Descriptive statistics involved the use of percentages, frequencies, measures of central tendencies (mean) and measures of dispersion (standard deviation) to describe the basic characteristics of the population. Inferential statistics involved the use of Pearson's Product Moment correlation and multiple regression models to determine the nature of the relationship between the variables. The multiple regression model was assumed to hold under the equation below;

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$

Where;

y = Project performance of registered building works contractors

β_0 = Regression model constant

X_1 = Critical Path Method

X_2 = Gantt chart

β_1 to β_3 are the coefficients of the variables to be determined by the model

e = the estimated error of the regression model

3.10. Assumption of Regression Model

Preliminary diagnostic tests were undertaken to ensure suitability of undertaking parametric statistics (correlation and multiple linear regression). The preliminary diagnostic tests include linearity test, autocorrelation tests and multicollinearity.

3.10.1. Linearity Tests

There must be a linear relationship between the outcome variable and the independent variables (Long & Ervin, 1998) as cited by Muchelule (2018). Linearity test is a requirement in the correlation and linear regression analysis. Linearity means that the predictor variables in the regression have a straight-line relationship with the outcome variable.

Linearity test assumes linearity of residuals. If the sig value is > 0.05 then the relationship between the independent variable is not linearly dependent.

3.10.2. Autocorrelation Tests

Another key assumption in regression model was that the error terms are independent of each other. Gujarati and Porter (2009)describe autocorrelation as the correlation between members of a series of observations duly arranged based on time and space. This study presented a simple test to determine whether there was autocorrelation (serial correlation), i.e. where there was a (linear) correlation between the error term for one observation and the next. When autocorrelation was present, it was suspected that the values for regression parameter's estimates are unduly large making corresponding p-values unduly small. In other words, in presence of autocorrelation, regression parameter's estimates may wrongly be interpreted as significant. Durblin-Watson statistic should be between 1.5 and 2.5 and if the rule is true then the data is not auto correlated.

3.10.3. Multicollinearity Tests

The term Multicollinearity refers to a situation in which there is an exact (or nearly exact) linear relation among two or more of the input variables, (Ochenge, 2018). A multi-co linearity test was done to ensure that the accepted independent variables do not exhibit co linearity amongst themselves. A situation in which there is a high degree of association between independent variables is said to be a problem of multi-co linearity which results into large standard errors of the coefficients associated with the affected variables. According to Mugenda and Mugenda (2013), multi-co linearity can occur in multiple regression models in which some of the independent variables are significantly correlated among themselves. In a regression model that best fits the data, independent variables correlate highly with dependent variables but correlate, at most, minimally with each other. Multi-co linearity is associated with Variance Inflation Factor (VIF) above 10 and tolerance below 0.1. Cohen, Cohen, West and Aiken (2013), provided that a VIF statistic above 10 is an indicator of multicollinearity and should be removed from regression models.

4. Research Findings and Discussion

4.1. Response Rate

Response rate equals the number of people with whom semi-structured questionnaires were properly completed divided by the total number of people in the entire sample (Creswell, & Creswell, (2017).The study issued 85 questionnaires to registered building works contractors out of which 70 successfully responded. Therefore, the total response rate was 82%. Babbie (2015) suggested that a response rate of 50% is adequate 60% is good and 70% and above very good for analysis. This implies that 82 percent response rate was very appropriate for data analysis.

Sampled No. of Respondents	No. of Questionnaires Returned	Response Rate (%)
85	70	82

Table 4: Response Rate

4.2 .Background Information

The general information of this study comprised of the gender, the education level of the respondents, the position of respondents in the organization, category of registration of the organization and duration they had been working in that organization.

4.2.1. Gender Distribution of the Respondents

The study sought to determine the gender of the respondents working with the registered building works contractors inNakuru County, Kenya. Table 4.2 shows the distribution of the respondents according to their gender.

Gender	Frequency	Percentage
Male	57	81
Female	13	19
Total	70	100

Table 5: Distribution of the Respondents

From the findings shown in Table 5, 81% of the respondents were male while 19% of the respondents were females this implies that most of the respondents were male. These findings are consistent with the report by construction industry artisan analysis 2018, which stated that 71% of the construction firms are owned by men whilst 21% have joint ownership of both men and women. Women owned companies account for only 7%. The findings implied that although majority of employees working with registered building works contractors in Nakuru County were male, the building works contractors were observant of the two thirds gender rule as enshrined in the Constitution of Kenya of 2010.

4.2.2. Highest Education Qualification

The respondents were requested to indicate their highest education qualification. The findings are indicated in Table 4.3

Education Qualification	Frequency	Percentage
Diploma	32	46
Bachelor's Degree	28	40
Master's Degree	9	13
Post-Graduate diploma	1	1
Total	70	100

Table 6: Highest Education Qualification

From Table 6, the study revealed that 46% of the respondents stated they had attained diploma education, 40% of the respondents stated they had attained bachelor's degree education, 13% of the respondents stated they had attained master's degree education, while1% of the respondents stated they had attained post-Graduate diploma education. This implies that majority 86% had a minimum of a diploma qualification suggesting that the respondents had adequate knowledge for providing sufficient information for the outcome of this study.

4.2.3. Position within the Organization

The respondents were requested to indicate their position held within the organization. Table 4.4 shows the distribution of the respondents according to the position held with the registered building works contractors inNakuru County, Kenya.

Position	Frequency	Percentage
Construction Manager	21	30
Construction supervisor	49	70
Total	70	100

Table 7: Position within the Organization

From Table 7, the study revealed that 30% of the respondents were construction managers while 70% of the respondents were construction supervisors. This implies that most of the respondents were construction supervisors.

4.2.4. Category of Registration

The study sought to determine the category of registration of the sampled registered building works contractors inNakuru County, Kenya. Table 8 shows the distribution of the respondents according to their category of registration.

Category	Frequency	Percentage
NCA 1	0	0%
NCA 2	0	0%
NCA 3	6	9%
NCA 4	9	13%
NCA 5	8	11%
NCA 6	15	22%
NCA 7	21	30%
NCA 8	11	15%
Total	70	100

Table 8: Category of Registration

From Table 8, the study revealed that 9% of the construction companies were in NCA category 3, 13% of the construction companies were in NCA category 4, 11% of the construction companies were in NCA category 5, 22% of the construction companies were in NCA category 6, 30% of the construction companies were in NCA category 7, while 15% of the construction companies were in NCA category 8. This implies that majority of construction firms under study were in NCA category 7. According to NCA (2011), the construction sector is dominated by small and medium enterprise contractors which account for a total of 79% while large establishment contractors account for 21%. The Contractors registration establishment in Kenya has 8 distinct categories ranging from NCA1 (Highest) to NCA8 (Lowest) with most of the contractors doing more than one class of work. The main classes of work include Roads, Water, Building, Electrical and Mechanical.

4.2.5. Duration in the Building Construction Industry

The respondents were asked to indicate the duration they had been in the construction industry. The findings were as presented in Table 9

Years	Frequency	Percentage
Less than 5 Years	18	26%
5-10 Years	25	36%
11-15 Years	15	21%
16-20 Years	7	10%
Over 20 Years	5	7%
Total	70	100

Table 9: Duration In The Building Construction Industry

From Table 9, the study revealed that 26% of the respondents stated they had been working in building construction industry for less than 5 years, 36% of the respondents stated they had been working in building construction industry for 5-10 years, a significant 21% of the respondents stated they had been working in building construction industry for 11-15 years, 10% of the respondents stated they had been working in building construction industry for 16-20 years while 7% had been working in the building construction industry for over 20 years. This implies that, cumulatively Majority, 74% of the respondents had worked in building construction industry for over 5 years in Nakuru County. The fact that 74% of respondents had over 5 years of experience means they were well experienced in the building constriction works and therefore they were competent enough to provide reliable information related to the study.

4.3. Diagnostic Tests

This section presents the results of the following diagnostic tests: Tests of Linearity, Multicollinearity Test and Autocorrelation Tests.

4.3.1. Tests of Linearity

According to Osborne and Waters (2012), the relationship must be linear for regression models to accurately estimate the relationship between dependent and independent. Results presented in Table 4.16 shows that the F statistic is significant at 0.05 significance level and therefore the study concluded that there exists a significant linear relationship between the dependent and the independent variables, and thus the data on the variables of this study were appropriate for regression analysis. The test results are shown in Table 4.16

4.3.2. Multicollinearity Test

When there is a perfect linear relationship among the predictors, the estimates for a regression model cannot be uniquely computed. The term collinearity implies that two variables are nearly perfect and linearly correlated to one another. When more than two variables are involved, it is often called multicollinearity, although the two terms are often used interchangeably. The primary concern is that as the degree of multicollinearity increases, the regression model estimates of the coefficients become unstable and the standard errors for the coefficients can get wildly inflated. The "tolerance" is an indication of the percent of variance in the predictor that cannot be accounted for by the other predictors, hence very small values indicate that a predictor is redundant, and values that are less than 10 may merit further investigation. The VIF, which stands for variance inflation factor, is (1 / tolerance) and as a rule of thumb, a variable whose VIF value is greater than 10 may merit further investigation.

Variables	Collinearity Statistics	
	Tolerance	VIF
Critical Path Method	0.552	1.813
Gantt Chart Technique	0.439	2.277

Table 10: Tolerance and VIF Test

From Table 10, the findings of the study established that the variable critical path method had a tolerance of 0.552 and a VIF of 1.813 and Gantt Chart Technique had a tolerance of 0.439 and a VIF of 2.277. Since the tolerance for all the variables was more than 0.1 and the VIF was not more than 10 therefore there was no need of further investigations.

4.4. Findings of Study Variables

The study examined the influence of scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya. The main scheduling technique studied included critical path method and Gantt chart while the dependent variable was project performance of registered building works contractors in Nakuru County, Kenya.

4.4.1. Critical Path Method and Project Performance

The first objective of the study sought to establish the influence of critical path method on project performance of registered building works contractors in Nakuru County, Kenya. The frequency adopted Likert scale. Table 11 shows the statistical results in detail.

Statement	SA	A	N	D	SD	Mean	Std
	%	%	%	%	%		
Through Critical Path Method project managers are able to accurately determine the approximate cost of the project	34	46	2	18	0	3.62	0.88
Through Critical Path Method project managers are able to accurately determine the timelines of various project activities	37	53	1	11	0	3.85	1.04
Through Critical Path Method project managers are able to identify the activities that must be completed on time in order to complete the whole project on time.	32	48	3	7	10	3.76	1.06
In case of resource constraints Critical Path Method can be used to identify the tasks that can be delayed without affecting project completion time	36	54	3	7	0	3.73	1.09
Through Critical Path Method project manager is able to monitor the rate of project implementation progress	41	49	3	5	2	3.36	1.19

Table 11: Critical Path Method and Project Performance

According to the findings, Table 11, majority of the respondents (46%) agreed thatthrough critical path method project managers are able to accurately determine the approximate cost of the project, with a mean of 3.62 and standard deviation of 0.88. Further, majority of the respondents (53%) agreed that through critical path Method project managers are able to accurately determine the timelines of various project activities with a mean of 3.85 and standard deviation of 1.19. This agrees with the study by (Jayawardena, 2016) which stated that critical Path Method is a powerful tool for planning and management of all type of projects. It provides a precise mathematical approach for planning, scheduling and control and allows ready evaluation and comparison of alternative work programmes, construction methods and types of equipment by changing individual activity durations, resources or relationships between activities. As reported by (Bokor, 2014), CPM is capable of storing logic that has been created, and in consequence allows easy modifications to the original plan.

Majority of the respondents (48%) also agreed that through critical path method project managers are able to identify the activities that must be completed on time in order to complete the whole project on time with a mean of 3.76 and within a standard deviation of 1.06.CPM encourages efficiency by optimizing the sequence of scheduled activities, or tasks, in a project. It is the essential part of the project for developing logic of the network and also for managing day to day project activities. It provides the direction required for success to the project.

From the study mmajority of the respondents (54%), agreed that in case of resource constraints critical path method can be used to identify the, tasks that can be delayed without affecting project completion time with a mean of 3.73 and standard deviation of 1.09 According to Loulakis & McLaughlin, (2016) the researcher stated thatin order to qualify for this category, the project schedule must cover all of the core project phases and be based on CPM techniques. The schedule network should have a discernable critical path and should avoid excessive activity float.

In addition, majority of the respondents (49%) agreed that through critical path method project managers are able to monitor the rate of project implementation progress with a mean of 3.36 and a standard deviation of 01.19. The findings are in line with Bokor, (2014) who observed that any delay of an activity on the critical path directly impacts the planned project completion date. A project can have several, parallel, near critical paths. CPM closely follows the deliberative action model, since it attempts to create a virtual, equivalent and complete model of the project to perform.

4.4.2. Gantt Chart and Project Performance

This section presents the descriptive analysis of the second objective of the study which sought to examine the influence of Gantt chart technique on project performance of registered building works contractors in Nakuru County, Kenya. Table 12 shows the descriptive statistics and results in details

Statement	SD	D	N	A	SA	Mean	Std
	%	%	%	%	%		
Through Gantt charts project managers are able to track project outcome on time	6	14	8	40	22	3.83	1.30
Through Gantt charts project managers are able to know what work is scheduled to be done on a specific day or time	7	3	10	45	35	3.79	1.37
Through the use of Gantt chart project managers are able to know how long each task of a project will take before completion.	8	12	3	37	40	3.83	1.36
Through the use of Gantt charts project managers are able to coordinate and track specific tasks in a project	6	4	3	40	47	3.99	1.35
Through the use of Gantt charts project managers can track the outcome on time enabling correction where necessary to avoid mistakes	5	6	3	46	40	3.85	1.33
Gantt charts help project managers to identify individuals involved and responsible of various project tasks	4	5	2	40	49	3.66	1.37

Table 12: Gantt chart and Project Performance

From Table 12, the findings of the study revealed that majority of respondents (40%) agreed thatthrough Gantt charts project managers are able to track project outcome on time with a mean of 3.83 and within a standard deviation of 1.30. The findings are consistent with those reported by Bokor, (2014) that the chart has the advantages of easy to prepare, easy to interpret and understand. Compared to most planning tools, the Gantt chart is a very good communicative tool, especially in the industry where most of the artisans are not highly educated. In view of this it is the most widespread way of displaying project plans

Further the Majority respondents (45%) agreed that through Gantt charts project managers are able to know what work is scheduled to be done on a specific day or time with a mean of 2.79 and a standard deviation of 1.37. The findings agree with gr, (2018) who argued that Gantt charts help project managers to track the outcome on time enabling correction where necessary to avoid mistakes and bring the project to path. In addition, Majority respondents (40%) strongly agreed that through the use of Gantt chart, project managers are able to know how long each task of a project will take before completion with a mean of 3.83 and a standard deviation of 1.36. This agrees with the empirical study of Clark, (2015) that the rate at which the work goes forward is continuously compared with the advance of time, which induces action to accelerate or retard that rate. These charts are not static records of the past they deal with the present and future and their only connection with the past is with respect to its effect upon the future.

From the study, Majority of the respondents (47%) strongly agreed that through the use of Gantt charts, project managers are able to coordinate and track specific tasks in a project with a mean of 3.99 and a standard deviation of 1.35. These findings are consistent with (Grigore *et al,* 2018, Freeman & Beale, 2015) whom stated that Gantt charts are useful for monitoring project progress. One can track the outcome on time enabling correction where necessary to avoid mistakes and bring the project to path. This is possible due to the graphical presentation of the activities. Projects management is viewed at small manageable items which can easily be visualized, parallel processes discovered, time for each determined and tracked.

In addition, majority of the respondents (46%) agreed that through the use of Gantt charts, project managers can track the outcome on time enabling correction where necessary to avoid mistakes with a mean of 3.85 and a std deviation of 1.33. This concurred with the study of Grigore *et al,* (2018), who reported that one can track the outcome on time enabling correction where necessary to avoid mistakes and bring the project to path. This is possible due to the graphical presentation of the activities. Projects management is viewed at small manageable items which can easily be visualized (Freeman & Beale,2015), parallel processes discovered, time for each determined and tracked. Furthermore, majority of the respondents (49%) strongly agreed that Gantt charts help project managers to identify individuals involved and responsible of various project tasks with a mean of 3.66 and a standard deviation of 1.37. The findings agree with Clark (2015) who observed that the rate at which the work goes forward is continuously compared with the advance of time, which induces action to accelerate or retard that rate.

4.4.3. Project Performance of Registered Building Works Contractors

The dependent variable of the study was project performance of registered building works contractors in Nakuru County, Kenya

Statement	SD	D	N	A	SA	Mean	Std
	%	%	%	%	%		
Our agency completed the project during the last two years at the stipulated time	2	8	5	50	30	3.83	0.68
Our agency has not experienced cost overruns in the last three years	3	7	10	30	50	3.94	1.03
The stakeholders are satisfied with the project quality	4	6	10	35	45	3.92	1.01
Our project team are normally paid in time	2	8	8	42	40	3.82	1.07
Our projects have not experienced delay in scheduled start date in the past year.	3	7	3	47	40	3.69	1.08

Table 13: Project Performance of Registered Building Works

From Table 13, the findings of the study established that majority of the respondents (50%) agreed thattheir agency completed the project during the last two years at the stipulated time with mean of 3.83 and a standard deviation of 0.68. This agrees with a study conducted by Neamat (2017), on the factors affecting project performance in Kurdistan Region of Iraq. The findings of his study revealed that project delay occurs due to shortage and closure of materials; the labors' availability in their work according to project duration; managing of projects and providing the skills of leadership; Alteration in prices of materials; highly qualified and expert persons need. The findings also revealed that cash flow is significant since it measures the performance cost in every level of constructing work. The researcher recommended that constructing organizations should reach their strong purpose in their production.

Further, most of the respondents (50%) strongly agreed that their agency had not experienced cost overruns in the previous three years with a mean of 3.94 and within a standard deviation of 1.03. This agrees with a studyby Kihoro and Waiganjo (2015) on factors affecting performance of projects in the construction industry in Kenya. His study focused on three aspects of performance namely timely completion, cost management as well as quality. The findings indicated that there was a strong positive relationship between project planning, stakeholder management, competence of project team and performance of the project.

Majority of the respondents (45%) also strongly agreed that the stakeholders were satisfied with the project quality with a mean of 3.92 and a standard deviation of 1.01. According to Melba, Dhanya and Ramasamy (2015) on factors affecting the performance of the construction projects. From the findings the top five factors affecting the performance of projects were identified as increase in material cost, inadequate supply of labour, incorrect planning, wrong method of estimation, and poor financial control on site.Furthermore, majority of the respondents (42%) agreed that their project team were normally paid in time with a mean of 3.82 and a standard deviation of 1.07. As established by Nyangwara and Datche (2015) while studying the factors affecting the performance of construction projects in the Coastal Region of Kenya, the most important factors agreed by the owners, consultants and contractors were average delay because of closures and materials shortage; availability of resources as planned through project duration; leadership skills for project manager; escalation of material prices; availability of personals with high experience and qualification; and quality of equipment and raw materials in project. In addition, majority of the respondents (47%) agreed with a mean of 3.69 and standard deviation of 1.08 that their projects have not experienced delay in scheduled start date in the past year. These findings contrast those of Onjure and Wanyoike (2016) on the influence of monitoring and evaluation practices on performance of national government funded construction projects in Uasin Gishu County-Kenya who concluded that monitoring tools have no statistically significant relationship with the performance of national government funded construction projects.

4.5. Inferential Statistics

The Pearson product-moment correlation coefficient was used to obtain a measure of the strength of association between two variables (Independent and Dependent). The Pearson correlation coefficient, *r*, can take a range of values from +1 to -1. A value of 0 indicates that there exists no association between the independent and the dependent variables while a value greater than 0 indicates a positive association meaning that an increase in the value of one variable leads to the increase in the other. A value less than 0 indicate a negative association meaning that a decrease in the value of one variable would lead to a decrease in the value of the other. The study sought to determine the relationship between various variables, to achieve this, the researcher used simple regression analysis, multiple regression analysis and Pearson correlation. The findings are illustrated in Table 14, Table 15below.

4.5.1. Correlations between Critical Path Method and Project Performance

The study conducted a correlation analysis between critical path method and project performance of registered building works contractors in Nakuru County, Kenya. The results are illustrated in Table 14

		Project Performance
Critical Path Method	Pearson Correlation	0.472**
	Sig. (2-tailed)	0.000
	N	70

Table 14: Correlations between Critical Path Method and Project Performance
**. Correlation is significant at the 0.01 level (2-tailed)

The study results indicated in Table 14, established that there exists a strong positive and significant relationship (r = 0.472, P=0.000) between critical path method and project performance of registered building works contractors in Nakuru County, Kenya. This implies that implementation of scheduling techniques related to critical path method are responsible for the increase in project performance. This implied that both critical path method and project performance change in the same direction. Hence if the critical path method is adopted, most of projects will enhance their performance. This is line with Jayawardena, (2016) study which observed that critical path provides a precise mathematical approach for planning, scheduling control and allows ready evaluation and comparison of alternative work programs, including the construction methods and types of equipment by changing individual activity durations, resources or relationships between activities which in turn improves performance.

4.5.2. Correlation Analysis between Gantt chart Technique and Project Performance

The study conducted a correlation analysis between Gantt chart technique and project performance of registered building works contractors in Nakuru County, Kenya. The results are illustrated in Table 15

		Project Performance
Gantt Chart Technique	Pearson Correlation	0.294**
	Sig. (2-tailed)	0.000
	N	70

Table 15: Correlation Analysis between Gantt chart Technique and Project Performance
**. Correlation is significant at the 0.01 level (2-tailed)

The study results indicatedin Table 15, established that there exists a moderate positive and significant relationship (r=0.294, P=0.000) between Gantt chart technique and project performance of registered building works contractors in Nakuru County, Kenya. This implies that implementation of scheduling techniques related to Gantt chart technique are responsible for the increase in project performance. This implied that both Gantt chart technique and project performance change in the same direction. Hence if the Gantt chart technique is adopted, most of the projects will ameliorate in their performance. This is in line with Waihumbu (2015), who observed that Gantt chart techniques clearly illustrate the project status, where it can be adjusted frequently to reflect the actual status of project tasks, it also helps manage the temporal dependencies between tasks, it keep users on track enabling them to think clearly about what must be done to accomplish their goal.

4.6. Regression Analysis

The multiple linear regressions were undertaken for the purpose of examining the influence of project life cycle management on projects performance. The model summary on Table 16 indicated a multiple linear correlation coefficient R of 0.701 which indicated that the independent variables (CPM and Gantt chart) had a positive correlation with the dependent variable. The coefficient of determination (R Square) of 0.474 indicated that the independent variable constituted 47.4% of the variance in the dependent variable.These results therefore explained 47.4% while the 52.6% is explained by other variables outside the scope of this study.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.701a	0.491	0.474	0.713

Table 16: Regression Model Summary
Predictors (Constant): Critical Path Method, Gantt Chart Technique
a.   Dependent Variable: Project Performance

The study conducted a regression analysis to find out the strength of the relationship between independent and dependent variables as shown in Table 16. The findings show that selected scheduling techniques is 47.4% as explained by the independent variables under this study while 52.6% is the variation due to other factors which have not been covered in this study. The finding is consistent with Nyambura (2017) who found that, Gantt charts and other factors accounted for 62% variation in project performance.

4.6.2. Analysis of Variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	73.554	2	36.777	32.317	.000b
	Residual	76.263	67	1.138		
	Total	149.817	69			

Table 17: ANOVA
Predictors (Constant): Critical Path Method and Gantt Chart Technique
a.   Dependent variable: Project Performance

As illustrated in Table 17, the F statistic = 32.317. Since the f calculated is greater than f statistic, it infers that the model is statistically significant. Therefore, there is strong evidence that the regression results are statistically significant and the variation in the results is insignificant that cannot result to much difference in case of a change in the study units (population) and therefore the model did for the data.

4.6.3. Multiple Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Beta	Std. Error	Beta		
1	(Constant)	2.026	0.420		4.824	0.000
	Critical Path Method	0.241	0.147	0.421	1.640	0.008
	Gantt Chart	0.219	0.144	0.286	1.520	0.036

Table 18: Multiple Regression Coefficients
a. Dependent Variable: Project Performance
b. Independent Variables (Constant): Critical Path Method, Gantt chart Technique

The study also conducted a regression analysis to establish the regression coefficients connecting the independent and dependent variables as illustrated by the equation illustrated below:
$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + e$
Whereby Y represents project performance., X_1 represents critical path method and X_2 represents Gantt chart technique. From the results in Table 18 the given equation was answered by the values of Unstandardized Coefficients (B) and all of them were statistically significant since their p values (Sig. <0.05) were less than 0.05. The results indicate that all the predictor variables in the study have a positive relationship with project performance of registered building works contractors in Nakuru County. Thus,
$Y = 2.026 + 0.241 X_1 + 0.219 X_2 + 0.420$
The value of project performance rates in Nakuru County without the influence of the predictor variables is 2.026. This explains that, at any given time, project performance will be 2.026 holding other factors constant at 0. The results also illustrate that, a unit change in critical path method would result to 0.241 times change in project performance of registered building works contractors in Nakuru County, a unit increase in Gantt chart technique would result to 0.219 times increase in project performance of registered building works contractors in Nakuru County, as given by the coefficients in the model

4.7. Hypothesis Testing
The study was based on the following null hypotheses:
- $H0_1$: Critical path method has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya

The study sought to test the hypothesis that: H_{01}: Critical path method has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya. From the findings the p-value was 0.008 which was less the 0.05 significant level. Therefore, based on the rule of significance, the study rejects the null hypothesis (H_{01}) and concluded that critical path method has significant influence on project performance of registered building works contractors in Nakuru County, Kenya which agrees with Bokor (2014), who stated that critical path method has significant effect on project performance.

- $H0_2$: Gantt chart has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya

The study sought to test the hypothesis that: H_{02}: Gantt chart has no significant influence on project performance of registered building works contractors in Nakuru County, Kenya. From the findings the p-value was 0.036 which was less the 0.05 significant levels. Therefore, based on the rule of significance, the study rejects the null hypothesis (H_{02}) and concluded that Gantt chart has significant influence on project performance of registered building works contractors in Nakuru County, Kenya. In addition, these findings agree with Grigore *et al*, (2018) who argue that Gantt charts help project

managers to track the outcome on time enabling correction where necessary to avoid mistakes and bring the project to path and concluded that Gantt chart has significant influence on project performance.

5. Summary of Findings, Conclusion, and Recommendations

5.1. Introduction
This chapter provides a detailed summary of the major findings of the actual study; it then draws conclusions and discusses implications emanating from these findings. Finally, it makes some recommendations and suggestions on areas of further study. The main aim of this study was to establish the influence of scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya.

5.2. Summary of Findings

5.2.1. Influence of Critical Path Method on Project Performance of Registered Building Works Contractors in Nakuru County
The study revealed that majority of the building works organizations adopts critical path method to improve the performance of their projects. Through critical path method project managers are able to accurately determine the timelines of various project activities. The critical path method affects how a project is managed from project planning to its completion date. Because the process typically involves forecasting, what-if analysis and a variety of detailed scheduling metrics, most businesses use project planning software programs rather than attempt to manage the project manually. In the planning phase, critical tasks are identified and listed in the order they're to be performed. The time required to complete each task is estimated. Critical Path Method (CPM) helps identify the most important activities, which can impact the project schedule. As such, this method is useful in creating project schedules and managing high-risk activities on the critical path. According to the results, the hypothesis that: Critical path method has no significant influence on project performance of registered building works contractors in Nakuru Countywas rejected. This implies thatcritical path method affects project performance of registered building works contractors in Nakuru County. Correlation analysis showed that there was found a positive and a strong significant association between critical path method and project performance. The hypothesis results indicated that there exists a statistically significant correlation between critical path method and project performance**.

5.2.2. Influence of Gantt chart Technique on Project Performance of Registered Building Works Contractors in Nakuru County
The study revealed that majority of the building works organizations adopts Gantt chart technique to improve the performance of their projects. The findings further revealed that through the use of Gantt charts project managers can track the outcome on time enabling correction where necessary to avoid mistakes. Gantt charts help project managers to identify individuals involved and responsible of various project tasks. For a project to be completed on time and budget the working team should be given full authority since that the project involves hundreds or thousands of tasks, Gantt chart will help in avoiding confusion among the various stakeholders involved in project management. Gantt charts help with task dependencies and interdependencies, identifying something that's called 'the critical path' of a project, which refers to a sequence of necessary tasks and activities that take the longest to complete. According to the results, the hypothesis that: Gantt chart technique has no significant influence on project performance of registered building works contractors in Nakuru County was rejected. This implies that Gantt chart technique affects project performance of registered building works contractors in Nakuru County. Correlation analysis showed that there was found a positive and a strong significant association between Gantt charts and project performance. The hypothesis results indicated that there exists a statistically significant correlation between Gantt charts and project performance.

5.3 .Conclusions of the Study
The study drew conclusions in respect of the findings from influence of critical path method and Gantt chart technique on project performance of registered building works contractors in Nakuru County, Kenya

5.3.1. Critical Path Method Project and Performance of Registered Building Works Contractors
From the findings the researcher concluded that building works organizations have established critical path methods which help them to perform effectively in their building works. Through Critical Path Method project managers are able to accurately determine the approximate cost of the project. Further the study concludes that through critical path method project managers are able to accurately determine the timelines of various project activities. In case of resource constraints Critical Path Method can be used to identify the tasks that can be delayed without affecting project completion time. The findings indicated that there exists a strong positive and significant relationship between critical path methods and project performance of registered building works contractors with a regression coefficient of 0.382.

5.3.2. Gantt Chart Technique and Project Performance of Registered Building Works Contractors
Regarding Gantt chart technique and project performance of registered building works organizations the researcher concluded that majority of the building works ensures Gantt chart techniques are adopted for effective performance of their projects. The researcher also concluded that through Gantt charts project managers are able to track

project outcome on time. The researcher further concluded that through the use of Gantt chart project managers are able to know how long each task of a project will take before completion. Through the use of Gantt charts project managers can track the outcome on time enabling correction where necessary to avoid mistakes. The findings indicated that there exists a strong positive and significant relationship between Gantt chart techniques and project performance of registered building works contractors with a regression coefficient of 0.504

5.4. Recommendations of the Study
In the light of the foregoing findings, the study drew its recommendations from the conclusions;

5.4.1. Critical Path Method Project and Performance of Registered Building Works Contractors
Based on the conclusion the researcher recommended that in order for the building construction project to be effective project managers should adopt critical path analysis in determining the best time to start working on the project. Besides, through Critical Path Method project managers should accurately determine the approximate cost of the project. Further the study recommends that critical path method should be used to enable project managers to accurately determine the timelines of various project activities. In case of resource constraints Critical Path Method should be used to identify the tasks that can be delayed without affecting project completion time.

5.4.2. Gantt Chart Technique and Project Performance of Registered Building Works Contractors
The researcher further recommended that for accurate identification of time for various components of projects, building construction project should adopt Gantt Chart to help them prevent operations overlap and scheduling of project activities. The researcher recommended that building construction project should adopt Gantt Chart method in order to understand the sequence of specific activities during project implementation process. Regarding Gantt chart technique and project performance of registered building works organizations the researcher recommends that the building works contractors should ensure Gantt chart techniques are adopted for effective performance of their projects. The researcher also recommends that Gantt charts should be used to enable project managers to track project outcome on time. The researcher further recommends that the use of Gantt chart should enable project managers to know how long each task of a project will take before completion. Moreover, it is recommended that Gantt charts should enable project managers to track the outcome on time enabling correction where necessary to avoid mistakes.

5.5. Suggestions for Further Studies
The study focused on the influence of scheduling technique on project performance of registered building works contractors in Nakuru County, Kenya. From the study findings, further research should be carried out to assess other factors affecting the performance of registered building works contractors in Kenya. Also, further studies should be carried out to assess the influence of scheduling Techniques on project performance of registered building contractors at national level.

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