International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 04 | Apr 2024 www.irjet.net p-ISSN: 2395-0072

COMPARATIVE STUDY OF MULTI PRIME AND SINGLE PRIME CONTRACTING PERFORMANCE IN LARGE ROAD CONSTRUCTION PROJECT IN KENYA

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Abstract

Infrastructural developments in Kenya have been at its peak and this has led to rise of large construction projects in the country especially in Nairobi. Due to this boom in construction, there has been need to ensure that contractors fulfil their obligations that is to ensure that quality is achieved within the budget and time limits. There has been a delay in delivery of various large projects and this has resulted to increase in construction costs and even further having impact on the quality. This can be attributed to the contracting method employed in the execution of the projects. The study sought to determine whether multiple prime contracting was the best delivery method for road projects in Kenya. To attain the overall objective, the study specifically sought to to establish which is the best contracting method between multi prime and single prime is cost effective; to determine which contracting method between single prime and multi-prime is superior in relation to schedule; to establish which contracting method promotes contractor capacity building. The study employed an exploration and evaluation research design, combining both qualitative and quantitative research techniques. Primary data was collected by use of structured questionnaires from a target population of 400. A sample size of 86 respondents was generated using formula from Yamane (1967), from Engineer, site Managers, Contractors, Administrators, Architects, and Foremen. Data was analyzed both descriptively and inferentially using SPSS version 25. The study achieved a 79.0% response rate. Based on descriptive analysis, 36% of the projects were multi prime while 64% being single prime. The results indicated that 58.40% against 41.6% of the respondents agreed that there was delay in completion of roads projects in Nairobi City County. moreover, 38.30% of respondents felt that the projects were good, followed by excellent which had 20% of the participants, and then 18.30% of the participants felt that their projects completion rate was fair, while those who felt poor comprised 13.30% of the participants. Inferentially, 69.6% of the total variation in the values of Completion of road projects is explained by the combination of the independent variables.

Key words: Construction, Multi prime, Single Prime, Quality

1. INTRODUCTION

Large constructions in Kenya have been at its peak in the recent past, and as a result, it has led to a delay in delivery of various large projects and this has resulted to increase in construction costs and even further having impact on the quality. This can be attributed to the contracting method employed in the execution of the projects. Most of the large infrastructural developments are vision 2030 flagship projects and to realize this a mechanism must be put in place so as to ensure that the projects are delivered as fast as possible and within the budget. Prime contracting has been the prevalent conventional way of contracting method in Kenya. This is where the client or the developer chooses one contractor so as to execute the various designs or the works. Due to rise in upcoming large construction projects there has been need to have the projects delivered on time.

Research carried out by Kim (2017) focused on multi-prime contracting, as an alternative to general contractor contracts, in this study, two pilot building projects were executed under Multi prime contracts with direct owner management. The project performance in relation to construction costs, schedule, defects and participant satisfaction under the Multi prime contracts was compared to a general contractor contract which is single prime (SP) contracting, results from the research shows that there was a reduction in the construction costs but not as much as expected (8% reduction). Schedule and defects were not so different from those under a GC contract.

Research carried out by Memon et al., (2011) shows that technical factors lead to cost overruns, including lack of experience, the size of the project, mistakes in design, overall price fluctuations, and inaccurate estimations. It is noted that size of the

project would lead to cost overruns and the contracting methods can facilitate addressing these issues. According to Ofori (2012), the problems affecting Ghanaian contractors and consultants were found to be the same as those noted generally in reports on construction industries in other third world countries. The challenges identified particularly influencing the performance of Ghanaian contractors include lack of ability to obtain adequate working capital, insufficient organization, inadequate engineering competence and poor workmanship. It is evident that from this study that lack of capacity would lead to poor performance thus finding a contracting method that would remedy this situation.

According to Kim (2017), there have been significant debates as to whether the use of MP contracts or GC contracts is the most appropriate in construction projects. Generally, general contractors prefer to apply GC contracts, whereas specialty contractors prefer MP contracts. General contractors argue that MP contracts result in higher bidding costs, increased administrative expenses, more change orders, higher claims, and poor quality (Holland, 2020). In contrast, the specialty contractors argue that GC contracts result in higher costs and lower quality (Kim, 2017), with GC contracts result in 2.75% - 9.54% higher costs than MP contracts. Thus, previous research has attempted to determine the quantitative cost differences between MP and GC contracts.

1.2 Statement of problem

Most Construction contracts in Kenya have suffered extended periods of delivery, cost overruns, operational setbacks and monitoring and control issues. The bigger the project the higher risk to project delays, this adversely affects the project delivery time and may also result to litigation and arbitration issues in the project. Cost overruns in projects has been attributed to the rise of overheads which are incurred once a project is in delays. The longer a contractor takes on a given project the higher the costs and its costs are directly or indirectly transferred to the client or the developer. This has led to the increase of construction cost.

The emergence of devolution has also resulted to rise in large infrastructural projects and developments in the various counties in Kenya and some of the counties do not have local contractors who possess the capacity to execute large project. In this case the capacity of this contractors can only be boosted if they are multi contracted so that they can jointly work on the project. Especially in roads projects this can be easily executed and would even help in promoting the local contractors or even petty contractors so as to be collectively work on a large project. The capacity of implementing firms is one of the critical factors that affect the successful completion of a construction project. (Dean, 2012). Kwatsima (2016) conducted research on the identifying the causes of projects delay in large engineering projects. The study showed that lack of experienced contractor for large projects was one of the main factors, this is an indication of lack of contractor capacity to undertake large construction project. This shows that there is need to solve the issue of contractor capacity or rather find out if between the two contracting method which one provides for capacity development.

This study intended to address whether employing multi-Prime contracting would solve the problems presented by single prime contracting such as of delay in completion or enhance the fast-tracking of large construction projects within the time and budget limits.

1.3 Research Aim and Objectives

1.3.1 Main Objective

The main aim of this study was to determine whether multiple prime contracting was the best delivery method for road projects in Kenya.

1.3.2 Specific objectives of the study

i. To establish which is the best contracting method between multi prime and single prime is cost effective
ii. To determine which contracting method between single prime and multi-prime is superior in relation to schedule
iii. To establish which contracting method promotes contractor capacity building.

1.4 Scope of study

The scope of study involved assessment of performance of road projects executed using multi prime and also roads projects executed using single prime contracting. This will help to determine the best contracting method in execution of large road construction projects. This study will evaluate responses from construction professionals and consultants so as to find out between the two contracting methods which one provides for contractor capacity development.

2. Literature Review

2.1 Single Prime Contracting

Single prime (SP) contracting is considered to be predominant in Kenyan construction industry. It is widely known as general contracting. Kim (2017) defines a general contractor (GC) as one responsible for overseeing various trades, or subcontractors performing one trade. The General contractor who is also known as the Main Contractor (MC) is responsible for day-to-day activities for the whole project and the trades and all the sections in the project. In this delivery method the one contractor provides a single point of communication to the design team and responsible for all the sub-contractors and even the various trades in the project. Single prime contracts offer centralization of responsibility in the execution of the contract. In this contract, the designs are prepared with the design consultants then the client or together with the design team choose one contractor that will execute the works based on the design. Single prime contracting has been taunted as to have the following advantages: provide for central point of contact, easier to administer due to the centralization of responsibilities, as well as to have minimal conflicts that rarely arise in this set up. However, they have been known to take a long time and mostly it gets to schedule overruns, and that they are easier to administer due to the centralization of responsibilities.

2.2 Multi Prime Contracting

According to Gordon, (1994) Multi prime (MP) is defined as more than one contractor holding contracts directly with the owner to perform specific parts of the same project. This is a method where the client or owner hires one designer for the whole project and then have it divided into sub-projects and each is awarded to different single prime contractor. This is where a client divides a project into portions and then enters into separate contract for each portion. This is where the contractors are hired directly by the client for different project phases either concurrently or consecutively. This method allows for phased construction which make it faster and cheaper.

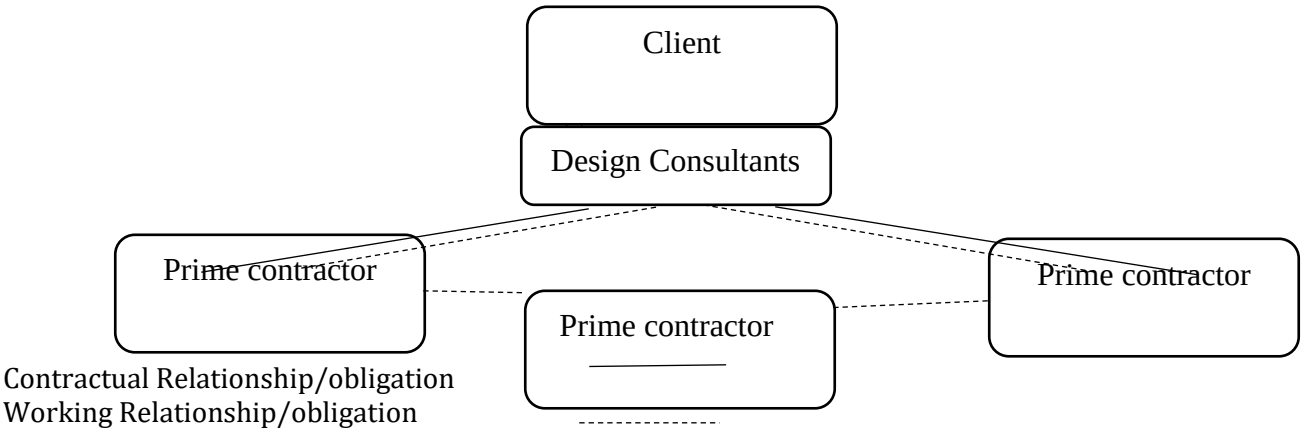

Figure 2-2: Multi-prime contracting

Figure 1: Multi prime Contracting

This method is can be used for projects that are to be delivered speedily. It is one of the best methods that can be employed in the fast-tracking of projects or if there is an emergency situation. There are contractors that are known for various special works which could be a discrete package in an entire project and awarding these contractors separately would ensure that quality and effective project delivery since the contractors would work together though by specialization. Among the notable advantages include: faster delivery of a project, increased competition on the various contractors would lead to lower bid cost, as well as that it could result to quality works since it encourages specialization, the client can engage the best contractor for a particular service rather than having a single prime contractor who may not have the expertise. This is especially in building. However, Multi-prime contracting has the following disadvantages: high supervision costs, if not properly managed would lead to rise of conflict and blame game, increased bidding time and cost since each sub-project is handled differently and negotiations done for the various contractors, and that the client looses central point of contact and this would bring bin the element of increased risk.

2.3 Factors to consider in Multi Prime Contracting

2.3.1 Scope

Construction megaprojects can be broken down into smaller and more manageable sub-projects. This will assist in avoiding procrastination and ensure that there is timely completion. Single prime contractors in Kenya especially the ones involved in large projects always start the projects and mid-way they feel overwhelmed and the tasks seem insurmountable. According to Weijde (2008), a well-defined project scope is key to the successful completion of project as per required quality and within budget and time limit.

In reference to project management, scope definition is done the pre-planning phase, this effort is proven to be an effective way of increasing the chances of project success while significantly decreasing the risks that could arise during project implementation. It is observed that projects that have a well-defined scope in pre-planning phase are not likely to encounter scope creep, schedule slippages, cost overruns, and poor quality of deliverables (Morris,2005).

This can be actioned by breaking down the bigger project into smaller subprojects which would make the work more operational towards achieving the required quality of project within budget and time limits or even in a fast track mode. Below are the key steps to in breaking down scope into smaller sectionsScope definition of the various sub-projects is very key to ensuring that the various contracts and contractors are well managed and a frictionless progress of the entire project. If multi-prime contracts are not properly pre-planned and executed, construction delivery could yield cost and schedule overruns due to the issues over contractors' responsibilities and disagreements especially scope of work (Kuprenas and Rosson 2000). Interfaces in the sub-projects should be well identified during the stage of scoping and well apportioned so as to ensure that there is reduction of conflict during the execution.

2.3.2 Contract sum of the project

Contract sum is the amount agreed upon with the contractor and it is entered into a contract. The contract sum or value can be of consideration to look into multi prime contracting especially for government projects. A case where the contract sum would be too big, the government can decide to break down the project into sections then give it to various contractors so as to help in the distribution of income to a lot of contractors.

There are projects that involves large contract sums that if awarded to one contractor there will not be equality or rather wealth

2.3.3 Time Constraints/Concerns

According to Gaturu et al (2014) the completion of projects in a timely manner is often a critical factor and measure of project success and the success of any project is highly dependent on its completion time from start to delivery of results. Kariungi (2014) also stated that completion of projects within schedule is a major contribution towards the competitive edge in organizations. This is based on the realization that the achievement of the targeted objectives is determined by the ability to deliver the targeted output within the stipulated time. It is widespread that most large construction projects suffer extension of time and delay in completion due to the contractor failures and having a multi prime contracting delivery would help mitigate these delays and extension of time.

2.3.4 Management and Coordination in Multi Contracting

Management and supervision of multi-prime contracting is difficult and the coordination work to ensure that there is a good working relationship among the contractors in executing there respective sub-projects is not easy. For successful results or rather if the project is complex the client could hire a construction manager so as to manage the scope of the various prime contractors. This can also be applied if the client through the design team do not possess the ability to supervise the various contracts (Monti 1997). For proper planning a construction manager needs to come in during the initiation of the project and ensure that all the necessary measures are taken so as to deliver the project with little or no conflict and within budget and the expected timeframe. (Kuprenas and Rosson 2000). The construction manager can also introduce internal coordination meetings with the various contractors at various steps of the projects and from this this would reduce conflict and solve any issue that might arise during the execution of the project.

2.4 Contractor Capacity Building

Contractor Capacity is the ability to possess all required documents and qualifies for the desired category and class of works. This is where the contactor is well equipped with resources that can enable them to carry out a given class of works (Gacheru, 2015). Contractor capacity building is whereby there is an endeavor to ensure that the contractors are endowed with all the required resources so that they can be in a position to undertake various classes of projects. This is also enhancing the skills, knowledge and abilities of contractor firms.

According to Gacheru, (2015) Capacity building involves money, material, methods and manpower. It is noted that methods used in undertaking large construction road projects can also enhance capacity building for the contractors. In some types of projects the local and petty contractors have limited capacity to undertake them due to technology, skills, human resource and funds to facilitate the project. Construction methods have been in question on how they intend to increase the contractor capacity since majority of our contractors do not possess the ability to undertake large projects. Capacity is enhanced when people or firms come together to share knowledge, technology, skills and resources.

Table 2: Logical Framework Matrix

Specific objectives	Research Activities	Requirements	Output	Assumptions
To establish which is the best contracting method between multi prime and single prime is cost effective	Identify large road projects undertaken by the single and multi-prime contracting	Survey in Nairobi and Neighboring counties	Prepare a questionnaire	
	Data collection	Development of questionnaire	Obtaining or extraction of data	
		Conduct a pilot study	No ambiguity in the questionnaire.	
	Data Analysis	Use of tables, charts and Graphical methods.	Tables and charts showing the cost performance of each method	The two contracting methods will show different results.
To determine which contracting method between single prime and multi-prime is superior in relation to schedule	Sampling of large road projects undertaken by the single and multi-prime contracting	Survey in Nairobi and Neighboring counties	Identification of large road projects undertaken by the single and multi-prime contracting	
	Data collection	Development of questionnaire	Obtaining or extraction of data	
		Conduct a pilot study	No ambiguity in the questionnaire.	
	Data Analysis	Use of tables, charts and Graphical methods.	Tables and charts showing the schedule performance of each method and recommendations	The two contracting methods will show different results.
To establish which contracting method promotes contractor capacity building.	Sampling of construction stakeholders	Survey in Nairobi and Neighboring counties	Identification of construction stakeholders.	
	Data collection	Development of questionnaire	Obtaining or extraction of data	
		Conduct a pilot study	No ambiguity in the questionnaire.	
	Data Analysis	Use of tables, charts and Graphical methods.	Tables and charts showing responses of the stakeholders in regards to the two methods and contractor capacity development	

3 RESEARCH METHODOLOGY

3.1 Research Design

This is to assess the information from selected cases where multi prime and single prime contracting have been employed. This research was designed to evaluate the project that have been undertaken with the two-contracting method. Contractor capacity development was measured using the questionnaire. To have proper analysis data will be collected from more than one respondent at any selected case, the participants are to have met required experience and knowledge with the issues on research, (Usman et al, 2014). Exploration and evaluation on the response or information from the road agencies, contractors, consultants and developers and from this recommendation for the applications of contracting method was made based on the results.

3.3 Research Strategy

This research adopted a case study and also combines qualitative and quantitative research strategies. For gathering of more information from questionnaires the two strategies was employed so as complement each other and facilitate in depth evaluation which would not have been covered if only one strategy was employed. (Bryman, 2012). This strategy aimed at gathering in-depth information from the respondents and questionnaires

3.4 Population, Sample and Sampling

3.4.1 Target population

According to Borg et al (2009) target population as is a universal set of research of all members of actual or imaginary set of people, events or objects to which an investigator wishes to generalize the result. The target population for this study were large road construction projects that have been constructed using multi prime contracting and single prime contacting within Nairobi City County. The population of the research comprised project Architects of active construction projects, Project Engineers and Project Managers in Nairobi City County. According to Nairobi City County Building and Architecture department, 250 proposals for residential and 150 proposals for commercial development were approved for construction in the past 12 months. Therefore, the researcher established the target population to be four hundred (400), and considered this to be adequate in providing data for the study.

3.4.2 Sampling and sampling techniques

The research employed purposive sampling since it allows for use of cases that have desired information in regards to the aims of the study. Case study sampling was also used as an investigative mechanism so as to identify the suitable method of contracting. Kochari (2016) defined a sample as a representative part of a population. According to Ngulube (2003) sampling procedure is the process of selecting a specific number of respondents for a study. In this study the most appropriate sampling technique is using formula from Yamane (1967), which provides asimplified formula to calculate sample sizes. This formula was used to calculate the sample sizes and is shown below.

A95% confidence level and P = .5 are assumed for Equation. Where n is the sample size, N is the population size, and e is the level of precision.

Mathematically derived Yamane formula

$$n = \frac{N}{1 + N(e)2}$$

Where:

n = required responsese = error limit

N = sample size

Placing information in the formula in diagram at a 95% confidence level and an error limit of10% results in:

$$n = \frac{800}{1 + 800\ (0.10)2}$$

= 86 responses

Eighty-six responses would therefore be the lowest acceptable number of responses to maintain a95% confidence level and a 10% error level. The sample size formulas provide the number of responses that need to be obtained. Many researchers commonly add 10% to the sample size to compensate for persons that the researcher is unable to contact. The sample size also is often increased by 30% to compensate for non- response. Thus, the number of mailed surveys or planned interviews can be substantially larger than the number required for a desired level of confidence and precision. Random sampling method will

be used to select the research respondents. In random sampling, each item or element of the population has an equal chance of being chosen. In this research the construction sites to be visited will be chosen randomly where they all have an equal chance ofparticipating in the research.

Table 3.1: Sample Size

Category	Target population	Sample size	Percentage
Road – Class C	650	65	75.58%
Road – Class B	150	21	24.42%
Total	800	86	100%

3.5 Data Collection

The researcher would use both primary and secondary data. Primary data consist of questionnaire and interviews and secondary data comprises of published documents, government publications contract documents for the desired contracts. The questionnaire includes structured and non-structured questions, structured was to facilitate easier analysis and the unstructured question encourage the respondents to give more or in-depth response.

3.6 Data Analysis

The research would generate both qualitative and quantitative data. The data would be tabulated in a way that would be analyzed by the Statistical Package for Social Sciences (SPSS) version 25. SPSS is suitable since it covers most of statistical and graphical data analysis it has also proven over time to be systematic. Descriptive statistical metrics such as percentages, mean score, and standard deviation and frequencies. Statistical methods will be employed so as to analyze the cost, schedule and comparison of the contractor capacity building of the two contracting methods. Analysis of Variance will be preferable for this study. For the analysis, the study will methods and techniques such as narratives, tables, and charts in the presentation so as to get the meaning of the data and facilitate easy understanding. From the analysis conclusions will be drawn and recommendations made.

3.7 Test for Reliability and Validity

Reliability is the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials (Maxwell, 2012). Reliability ensures that the data collected is consistent and is what is intended to achieve from the research. Validity is defined as the degree to which a test or a measuring device is truly measuring what it is supposed to measure. According to Creswell (2013), validity is the degree to which the results are obtained from analysis of data actually represents the phenomenon under study. To achieve this pilot test was administered so as to ensure that there will be internal consistency and that the respondents will not be having any difficulty in responding to the questionnaires. This is where a small-scale administration of the questionnaire is done so as to test the appropriateness of the questions and the comprehension of the respondents.

4. Data Analysis Presentation and Discussions

4.1 Response Rate

While a total of 86 questionnaires were sent to the field for data collection, 68 questionnaires were successfully filled and returned for analysis, yielding a response rate of 79.1%. this was considered sufficient enough for analysis following a recommendation of Mugenda and Mugenda, (2013) that a return rate of 50% is very good for analysis. Accordingly, Mugenda and Mugenda (2013) argues that the bigger the sample size, the more accurate the results of analysis are in terms of representation of the whole population. The data was analyzed using SPSS (Statistical Package for Social Scientists) version 26. The sample size for the study included 30 Engineer, 2 Manager, 20 Contractors, 5 Administrators, 10 Architects, 7 Foremen, and, 12 Other employees were considered for the study totaling to 86 respondents.

4.2 Demographic Characteristics of the Respondents

4.2.1 Bio-data of the Respondents

The table 4.1 above shows how the respondents were distributed by their gender. The findings show that female respondents were 21 representing 24% and male respondents were 65 representing 76%. It can therefore be concluded that the construction personnel population comprised mostly of males at 76%.

Table 4.1 Gender Composition of Respondents

Gender of the respondents	Frequency	Percent
Female	21	24%
Male	65	76%
Total	**86**	**100%**

4.2.2 Educational Level of Respondents

The study sought to establish the level of education of the respondents since engineers, foremen, managers, contractors, architects etc. were part of the population. The table 4.2 above shows how the respondents were distributed by their level of education. The information shows that majority of the respondents had university level of education represented by 50 respondents at 58%, 12 respondents at 25% of the respondents had secondary level of education whereas those with polytechnic level of education were 11respondents at 13% and those with primary level of education were only 2(2%). The results show that majority of the respondents in a construction firm are highly educated.

Table 4.2 Academic Qualification of Respondents

Level of education	Frequency	Percent
Primary	2	2%
Secondary	21	25%
Polytechnic	11	13%
University	50	58%
Other	2	2%
Total	**86**	**100%**

4.2.3 Project Types

The study sought to establish the distribution of projects as either multi prime or single prime projects. Table 4.3 above shows how the respondents were distributed by their project's types in the construction projects within Nairobi City County. The projects were 31 (36%) being multi prime, 55(64%) being single prime. The study hence concluded that the majority of roads projects in the County are single prime projects

Table 4.3 Distribution of the Project Types

Project type	Frequency	Percent
Multi Prime	31	36%
Single Prime	55	64%
Total	**86**	**100%**

4.2.4 Role of Project Managers' Competence

Respondents were asked to rate how the following factors related to the manager's competence affect the performance of construction projects in Nairobi City County suing a scale of 1-5; where: Strongly disagree = 1, Disagree = 2, Weakly agree =3, Agree =4 Strongly Agree =5 and the following results were obtained. From the table above, 46 respondents strongly agreed/supported the idea that the manager's qualification is important in implementing construction projects,30 agreed, 8 weakly agreed and 2 disagreed with the statement. On the important of Manager's experience, 36 strongly agreed with the idea, 20 agreed, 15 weakly agreed 10 disagreed while 5 strongly disagreed with the statement. 2 strongly disagreed with the statement that, Manager's management skills are important in a project 8 disagreed, 8 weakly agreed, 35 agreed, and 33 strongly agreed. On the factor that read, Communication system of project manager is important, 4 strongly disagreed, 7 disagreed, 12 weakly agreed, 33 agreed while 30 strongly agreed.

When asked to give the reasons for their views above, 76 respondents argued that if the manager is not competent and experienced, the construction projects could fail both in quality and objectives.10 respondents argued that experience and competence is not important in construction projects implementation but the willingness to perform duties efficiently. The study results are as presented in table 4.4

Table 4.4 Project Managers' Competence

Factor	1	2	3	4	5
Manager's qualification is important	0	2	8	30	46
Manager's experience is important	5	10	15	20	36
Manager's management skills are important in a project	2	8	8	35	33
Communication system of project manager is important	4	7	12	33	30

4.2.5 Length of Service Worked at Nairobi

In the context of the length of period worked in Nairobi, the results were illustrated using figure 4.1. The results indicated that 52.2%, 38.10%, 5.30% and 4.40% of the respondents had worked for 0-2 years, 3-5 years, 6-8 years, and more than 8 years respectively. The length of the period worked in their respective institutions is anindication of their experience levels in their functions and therefore the validity of their results. The results indicated that slightly less than half of the respondents had worked for more than 2 years and were therefore highly knowledgeable on the aspects addressed by the research. It is also worth noting that the county governments have only been in existence for a fairly short period of less than four years. The length of time worked is critical for the completion of the road projects in the county in the context that the persons who have stayed longer in the county are well familiar with the road network in the county and have also networked with diverse stakeholders.

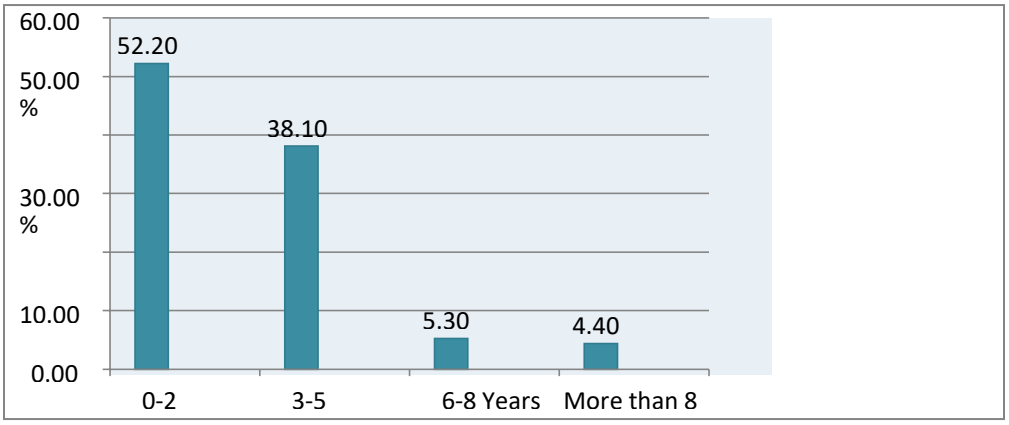

Figure 4.1: ***Length of Time Employed***

4.3 Analysis of Study Variables

The contract management levels were examined through use of completion rate of projects, project supervision rates, engagement of unqualified contractors, delay in paying contractors, changing of contract documents, and failure to supervise contractors. The following sections present the study results:

4.3.1 Completion Rate of Projects

The results for the completion rates of projects were examined through figure 4.4 below.The results indicated that 58.40% of the respondents agreed that there was delay in completion of roads projects in Nairobi City County while 41.6% of the respondents disagreed. The projects constructions of roads are often faced by diverse challenges that affect their completion rates including stakeholder management, funds availability, equipment availability and the general work pace of the contractor.

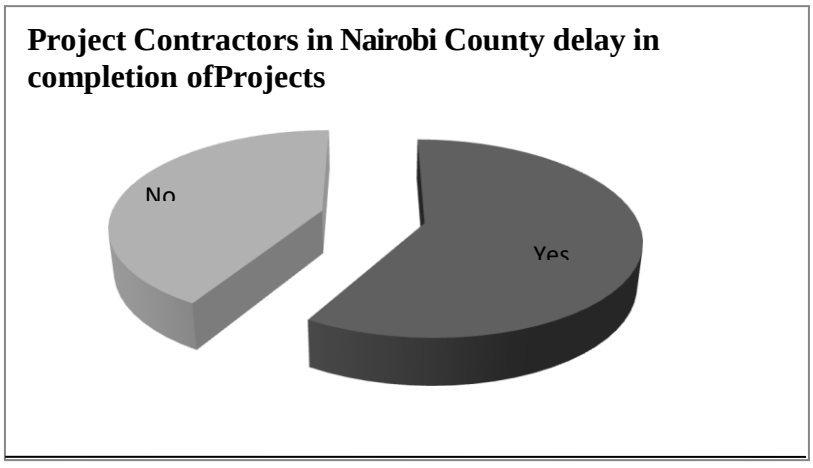

Figure 4.2: *Completion Rate of Contractors*

4.3.2 Project Duration

Time related factors are extremely important in deciding the appropriate delivery method. The first factor is ensuring that the construction of roads is completed with the shortest possible time. The second factor is completing the construction project on schedule but not necessarily the shortest time. Cost related factors are always at the center of decision making. These factors include ensuring that the construction project is completed with the lowestpossible time. The second factor is completing

the construction project within budget but not necessarily the cheapest. Figure 4.3 presents the comparison of the effectivenessof each delivery method with regard to time and cost related factors.

4.3.3 Scope, Changes & Quality Related Factors

Scope related factors include the level of scope definition at the time of contract award. Each delivery method requires a different level of scope definition to achieve the desired results. The level and number of changes expected during project execution is another factor affecting the choice of delivery method. The third factor is the flexibility to make changes. Many owners desire that the delivery method should be flexible enough to allow them to make changes as needed. Quality related factors include one factor to measure the project delivery method's ability to attain the highest overall quality. Although a high quality is always desired by owners, each method achieve these objective indifferent ways. The difference, however, is not as big as other factors. Figure 4.4 presents the comparison of the effectiveness of each delivery method with regard to scope, changes and quality related factors.

4.3.4 Project Delivery Methods Effectiveness

The set of selection factors that affect the owners' decision of the most appropriate delivery method were determined through literature review. For this research, twenty- one selection factors are identified and grouped into three (3) categories. The effectiveness of each delivery method in dealing with the different road project objectives (selection factors) was calculated as an average from all respondents. The effectiveness values aepresented in Table 4.5

Table 4.5. Delivery Methods Effectiveness Values

Selection Factors		1	2	3
		Design-Bid-Build	Construction Management	Design Build DB
1	Ensures Shortest Time	0	80	93
2	Stay On Schedule	30	83	96
3	Ensures Lowest Cost	89	82	80
4	Stay Within Budget	51	88	85
6	Handles Changes	2	31	95
7	Provides Flexibility	98	75	4
8	Attains Highest Quality	20	80	97
9	No Experience	48	98	89
11	More Owner's Control	89	75	10
12	Single Project Contract	22	17	99
13	Single Const. Contract	100	100	92
14	Delays Expenditure	89	90	5
15	Early Estimating	0	76	96
16	Allows Financing	0	0	0

The study sought to assess the projects' schedule related performance in terms of time taken. The respondents were required to provide the schedule related data of their project. This was measured in terms of estimated project duration, Contractor's bid duration, actual project completion duration, contractors schedule duration during bidding, and the final construction duration. Figure 4.5 presents the study result.

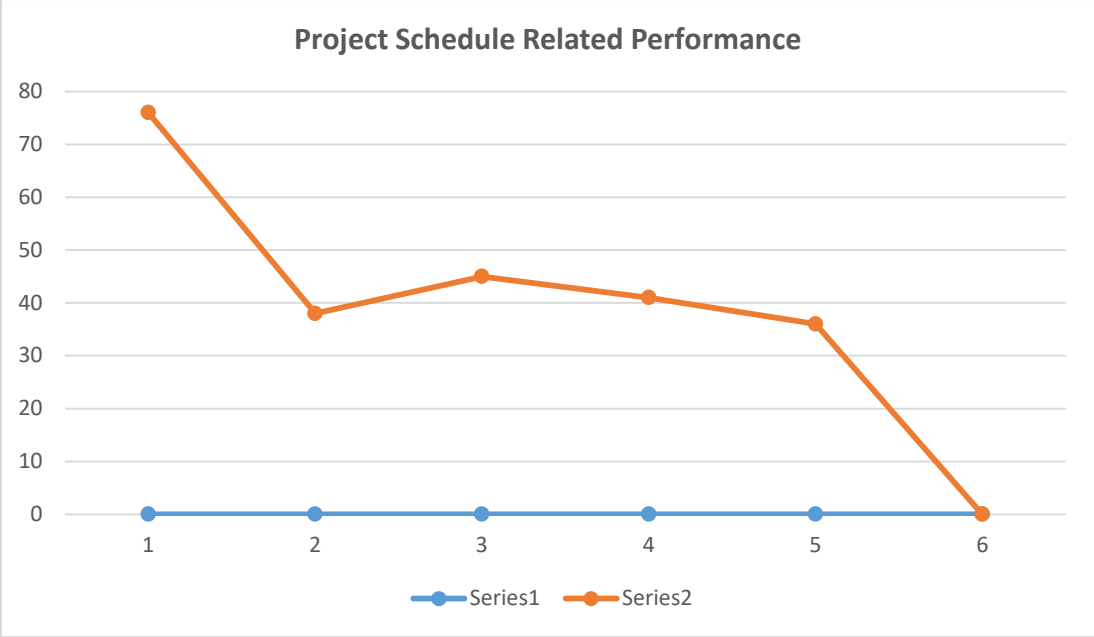

Figure 4.5: Projects' schedule related performance

4.3.5: Projects' Success rate

The respondents were asked to state on a continuum, their perception on the success rate of these projects. The study results are as presented in table 4.6. From the results, it was revealed that, majority of the participants (38.30%) felt that the projects were good, followed by excellent which had 20% of the participants, and then 18.30% of the participants felt that their projects completion rate was fair, while those who felt poor comprised 13.30% of the participants.

However, it emerged that the multi prime projects completion rate took longer, and in some cases poorly done, given diverse interests from the project stakeholders. The qualitative data indicated that these challenges ranged from financial constraints to a more complex behavioral conduct of corruption, and uncaring attitudes from the project management team, more so from the public service.

Table 4.6: Projects' Success rate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Excellent	12	20.0	20.0	20.0
	Good	23	38.3	38.3	58.3
	Fair	11	18.3	18.3	76.7
	Poor	8	13.3	13.3	90.0

4.1. 6: Contracting Capacity

The respondents were equally required to state which contracting method provides for contractor capacity development. The respondents were hence required to choose between Single Prime contracting and Multiple Prime Contracting, with the following table 4.7 showing study results. Accordingly, most respondents generally agreed that multi prime contracting is the most offers contractor capacity building with 60.3% while single prime had 39.7%

Table 4.7: Contracting Capacity

	Percentage
Single Prime Contracting	39.7%
Multi prime Contracting	60.3

4.4 Regression Model

The regression model was utilized for the purposes of examining the influence of the four independent variables on the dependent variable. The multiple linear regression coefficient of 0.842 indicated that there was a positive correlation between the three independent variables and the dependent variable. The adjusted R Square Statistic was 0.696. Thus, 69.6% of the total variation in the values of Completion of road projects is explained by the combination of the independent variables. The rest is due to chance or factors beyond this model. 62.9% value of adjusted R square shows a good fit.

Table 4.8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.842[a]	.709	.696	.47782

a. Predictors: (Constant), contracting method, contracting schedule, contractor capacity building

The ANOVA statistics were used to determine on whether the regression was a good fit for data. In this case since p value is 0.000 which is less than 0.05 then the regression was found to be good fit for data.

Table 4.9: ANOVA

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F	p-value
Regression	4	44.31	11.08	48.518	0.000
Error	108	24.66	0.228		
Total	112	68.91			

The regression model coefficients were derived from Table 4.11 to construct thefollowing regression model;

Completion of Roads = $-0.267+0.289x_1 + 0.986x_2 + 0.0326x_3$

Where X_1 is the contractor's prequalification, X_2 is the contracting method, X_3 is the Contract schedule and X_4 is Contractor capacity building. While holding Contracting method, contracting schedule and Contractor capacity building constant, performance in large road construction projects is likely to change by a .289 unit. The study results are as presented in table 4.10

Table 4.10: Linear Relationship Coefficients

	B	Std. Error	t	p-value
(Constant)	-.267	.401	-.665	.508
Contracting method	.289	.117	2.47	.016
Contracting schedule	.986	.122	8.057	.000
Contractor capacity building	.0326	.140	.325	.015

While each of the individual independent variables had a statistically significant linear relationship with the performance, some of them failed to pass the significance test in the multiple-linear regression model. The p-value for contract method was .016 which was below the .05 level rendering contract method to be having a linear relationship with the performance. Contracting schedule had a proven linear relationship with the response in the multiple-linear regression model at a p-value of 0.000. Contractor capacity building had p-values of .015 which was statistically significant.

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