INFLUENCE OF COST CONTROL PRACTICES ON THE COST PERFORMANCE OF CONSTRUCTION PROJECTS IN ABUJA-FCT, NIGERIA

BY

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MTECH/SET/2017/7504

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MINNA

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY (M.Tech) IN QUANTITY SURVEYING

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DECLARATION

I hereby declare that this thesis titled "Influence of cost control practices on the cost performance of construction projects in Abuja-FCT, Nigeria" is a collection of my original research work and it has not been presented for any other qualification anywhere. Information from other sources (published and unpublished) has been duly acknowledged.

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CERTIFICATION

This thesis titled "Influence of cost control practices on the cost performance of construction projects in Abuja-FCT, Nigeria" by OGUNGBE, Olusogo Bamidele (MTECH/SET/2017/7504) meets the regulations governing the award of degree of Master of Technology (M.Tech) of the Federal University of Technology, Minna and it is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This project is dedicated to the Almighty God, the beginning and the end.

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First and foremost, I will forever be thankful to Almighty God under whose guidance and protection. I am able to make headway in life.

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ABSTRACT

The Nigerian Construction Industry (NCI) faces numerous cost-related challenges that have in some cases increased costs of construction projects by up to 61.84%. Such challenges include the increasing complexity of construction projects which necessitate specialist skills required for their design, construction, operation and maintenance. The control of the cost of construction projects, Project Cost Control (PCC), is thus confronted by new problems, as well as the use of old tools. There is need for cost control methods that will assist project team members in identifying objectives, choosing cost control priorities and setting up a feedback system. The aim of this study was to assess the influence of cost control practices on the cost performance of construction projects as a means of recommending improvements in the cost control process on construction sites. This research was carried out in the Federal Capital Territory Abuja, which as the capital city of Nigeria, has numerous on-going construction activities. A random survey of 65 selected construction practitioners was undertaken with the use of structured, close-ended questionnaires. This research has found that ‘Controlling of sub contract cost’ (Mean Score = 4.49 on a 5.0 scale), ‘Cost variance (Mean Score = 4.48) and ‘Cost reports (Mean Score = 4.43) are the most frequently applied PCC practices. Conversely, construction professionals shied away from the use of S-curve for cost/time monitoring. The study also discovered that 80% of the sample always conducted variance analysis, while only 1% admitted to never checking deviations from budget through variance analysis. It was concluded that ‘Delayed/No payments for works done’ and ‘late/non-involvement of QS in project’ as well as ‘use of outdated cost control techniques’ were the major barriers to realization of the ideal benefits of PCC. These results reveal that more work still needs to be done in the area of use of tools for PCC; the study thus recommended that Quantity Surveyors be introduced to the project as early as possible to help address cost challenges right from the design stages through to the post construction.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Globally, construction industries are characterised to be dynamic and faced with lots of uncertainties, this has made cost control and management difficult to achieve, inevitably causing poor cost performance (Sinesilassie et al., 2018). Several construction project developments fail because of excessive pressure on designers to optimize value in terms of time, cost limit, and quality (Anyanwu, 2013). As mismanagement of resources in past times is among the leading cause of the economic depression, the country is presently experiencing, expressed in lack of resources and increased inflation. This calls for dedicated efforts geared towards ensuring that projects do not exceed budgets (Yismalet & Alemu, 2018).

Cost control describes a situation where the project costs associated with construction are managed through the use of scientifically proven tools and techniques. Such a situation ensures that a contractor is able to profit from executing the project. While seeking to construct at the cheapest possible cost, contractors are however bound to deliver the project within stipulated objectives (Kumar et al., 2015).

Ogege (2011) stated that all projects are conceived and designed to achieve a goal, irrespective of the size or nature. For it to be successful, it must be planned. A project can be considered successful in relation to certain criteria; time, cost, project effectiveness, quality and acceptance by the clients, although the definition of project success is subjective, as each stakeholder have his/her own definition of success. Successes and failures are relative terms and are highly subjective (Sinesilassie et al., 2018). Cost performance however refers to how closely the project's final cost approximates its initial, planned cost, which was set during the design stage of the project.

In the construction industry, majority of clients are concerned with getting facilities and projects that meet their expectations – which usually means completed within the stipulated time, cost, quality and scope. This has placed an additional new and complex burden on constructional professionals; Builders, Architects, Quantity Surveyors, Engineers and project managers (Kumar et al., 2015). Furthermore, the project cost management processes has increased in complexity owing to the use of novel procurement methods, construction technologies, material and equipment resources and specialists in new and varied fields. Project execution involves a substantial amount of resources; the loss of such resources through failure or abandonment of the project can effectively end the ability of investors and financiers to fund future projects. This means proper cost control and management is paramount (Ogege, 2011).

Construction costs and time are must be considered in the management of any project; both are also almost universally regarded as key performance indices for project success (Aziz et al., 2013). It is generally known that in the majority of cases the actual cost of project work exceeds the estimated cost (Kokate & Darade, 2018). To this end, methods are needed which allows members of the project team, to identify objectives and choose priorities for cost control systems. To achieve this, it is necessary to evaluate existing practices to establish best practices which enhance the influence of cost control practices on the cost performance of construction projects and feed back in the construction process.

1.2 Statement of the Research

It has been observed earlier that project cost control refers to a situation where the costs associated with construction projects are managed through the use of scientific tools and techniques, in order to ensure that contractors profit from carrying out projects. The problem of poor management and control of costs which eventually leads to cost overrun and failure in project execution occurs globally (Yismalet & Alemu, 2018). The failure to manage the costs of projects properly can lead to business collapse, which gives a poor image of the capacity of construction professionals and firms. Out-of-control project costs affect the economy at different levels – site, project, firm, local, national and global (Aziz et al., 2013).

Despite the enormous benefits attached to the cost control and management practices, the implementation of it is lacking in many countries, specifically on the African Continent (Matins, 2018). The effect of poor cost control appears more felt in developing countries, because overruns might be double or more of the estimated costs (Ullah et al., 2016). This situation has generated a lot of attention from stakeholders in the Nigeria construction industry, rooted as it is in poor management of information for estimating and cost control (Odediran et al., 2010).

Ikechukwu et al. (2017) noted that a lingering lack of cost control could lead to a decrease in project production, project abandonment and rate of national growth. Buildings are increasingly becoming complex and building clients more exacting in their demand for better value for their money (Cunningham, 2015), but the existing cost control practices in the Nigerian construction industry are not known for yielding efficient result, leading to almost all projects ending above the initial contract sum (Kokate & Darade, 2018). Thus control practices should take adequate account of the type of environment, the peculiar nature of projects and the set objectives among other things. Therefore the aim of this work is to appraise the influence of current cost control practices on the performance of building projects. this calls for a dire need to understudy the current influence of the cost control practices in the performance of the building projects in Abuja - FCT, Nigeria.

1.3 Research Questions

Consequent upon the above, this study will provide answers to the following questions:

i. What are the cost control techniques and practices in the Nigerian construction industry?
ii. To what level are these cost control techniques and practices implemented in the Nigerian construction industry?
iii. What are the problems encountered by firms during the implementation?
iv. What is the relationship between implementation of cost control practices and performance of building projects?

1.4 Aim and Objectives

1.4.1 Aims

The aim of this study is to assess the influence of cost control practices on the cost performance of construction projects in Abuja, FCT, Nigeria, with a view to recommending improvements in the cost control process on construction sites.

1.4.2 Objectives

The specific objectives of the study are:

i. To identify the cost control techniques and practices applied on construction projects in the study area.
ii. To determine the level of implementation of cost control techniques and practices.
iii. To examine the problems encountered during the implementation of cost control on construction projects
iv. To determine the relationship between implementation of cost control practices and performance of construction projects.

1.5 Justification for the Study

Cost control is an important aspect of the management of construction projects in any country. (Kumar et al., 2015) in their study of contractors in Uganda, identified major cost control techniques to be; schedules, budgets, inspections, reports, meetings, monitoring and use of bills of quantities.

It has become a commonplace in all stages of the construction development process to experience cost overruns due to lack of cost control, (Cunningham, 2015) outlined the need to focus on costs under PC sums and provisional sums, outlining procedures in respects to administration of variations, claims for increased costs of labours and materials. Furthermore (Kokate & Darade, 2018) stated in a residential building project understudied, due to proper cost control applied, the actual project duration was lower to the planned budget duration, as well as the actual cost against the budgeted cost.

Some researchers (Ogege, 2011; Anyanwu, 2013) have stated that the development of cost management and its application in trimming down cost can be best performed by Quantity surveyors, who receive additional training in the art of cost management, as opposed to other professionals in the construction industry. Malkanthi et al. (2017) however iterated that the problem is not that of lack of cost control techniques; rather, contractors lack sufficient incentive to gaurantee uptake of such tools.

Yismalet & Alemu (2018) also stated that to be efficient, a cost control system must be an early warning tool that allows economically faulty construction operations to be pinpointed and corrected in time. Such a tool must pay balanced attention to labour, equipments and overhead costs, which form the bulk of costs in most projects.

1.6 Scope of the Study

This research reviewed various techniques, systems and procedures adopted by firms in controlling the cost of construction projects in Nigeria and a recommendation of the most effective practices at both pre and post contract level. It shall be limited to professionals within Federal Capita Territory Abuja, in order to provide a balanced view of project cost control. Abuja was chosen because a lot of construction activities are carried out there and it is expected that reliable information will be available from respondents.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Cost Control

"Cost" is ambiguous term, since it means different things to various individuals. It is one of the primary measures of a project's success (Ikechukwu et al., 2017). To an accountant, it implies the element which aids production, which can then be divided into material, labour, and equipment costs. Holm & Schaufelberger (2021) defined cost in terms of payments for the different factors of production employed in the manufacture of specific units of particular product.

To the economist, cost is viewed in relative like terms, as the alternative foregone. In practical terms, if an individual has ₦1,000,000,000.00 with the choice of constructing a warehouse or a commercial complex, and chooses to construct the warehouse, the cost of erecting the warehouse is said to be the commercial complex.

Enyi (2007) defined cost as the expenses borne in process of bringing a construction project to fruition; such expenses might be fixed, variable and semi-variable in occurrence. Basically cost can be liquid cash required for the transaction of goods and services. In the construction industry, cost implies the burden on the client to contract and sub-contract a project to a firm; this is different from the cost of resources used in the project. In other words, cost is the amount the client pays for the project (Brandon, 2005).

To construction economists, Oforeh and Alufohai (2006) states that a true reflection of project cost is only obtained when the project is considered in terms of both the cost of acquisition and operation over its useful lifetime. Cost implies expenses incurred by contractor for labour, material, service, utilities, the client's expenses in initiating and completing a project. Cost control is the process by which a project cost maintained within the project budget in response to the various forces in cost fluctuations (Olaoluwa, 2013). It can also be the various activities involved in ensuring that project costs are kept within planned limits at all stages of the project (Kwak & Ibbs, 2002).

Udasi & Darade (2018) considered cost control to focus more on keeping project costs down; this can be done in various ways, such as replacing costly material with cheaper alternative materials. This will rely on past construction information to help reduce material waste, unnecessary equipment as well as costly but replaceable construction materials.

A periodic evaluation and monitoring of cost will help to identify activities that are costing more than they should; at this point, cost managers can choose the specific remedial actions to apply to return such activities to within budget. Cost control also enables project stakeholders to know how actual costs compare with planned costs at the completion of the project. If such is undertaken when the project has not been finished, then stakeholders are informed as to what it will take to finish the works (Eldash, 2013).

Cost control can work through effective planning of the project schedule; this can be done with qualitative techniques as well, and gives the client/contractor effective control over the available resources. Clients are mostly preoccupied with getting their projects completed as planned, in terms of cost, time and quality. The most well known means of achieving this is through effective control of the cost of the project, using a variety of proven tools and techniques. This benefits both the client (who gets the project he wanted, as he wanted) and the contractor (who is able to make a profit on the effective delivery of the project for the client) (Kumar et al., 2015).

Controlling a project’s costs occurs when the sequence of all work items in the project are established and standardized, as it’s the nature of projects to be dynamic, due to the following factors: (i) Resource availability, (ii) The Economy, (iii) Unexpected weather conditions, and (iv) Technical difficulties or construction methods. Others include (v) Revision of activity duration estimates, (vi) Relative priorities of projects, (vii) Budget considerations, (viii) The project completion time, and (ix) Technical specification of the project (Anyanwu, 2013).

A contractor's cost control system fulfils three main aims:

a) Aiding comparison between the actual and budgeted cost, and thus drawing attention, in a timely manner, to work items that are deviating from the project budget.
b) Creating a rich source of data on project productivity and costs which can be used in estimating the costs of future projects
c) Generating technical information that assists in estimating the value of works that were not included in the contract originally (such as variations, changes to the contract and claims) (Anyanwu, 2013).

2.2 Cost Control Techniques

Cost control occurs at various stages of a building construction project; pre-design, design, construction and post construction stages, in order for the project to be achieved within budget. A cost control system depends on a variety of theoretical and practical tools and techniques (Cunningham, 2015). An overview of existing cost control systems is important in this section, so as to provide a theoretical background to the study.

2.2.1 Cost control techniques at the pre-contract stage

Cost control at design stage can follow one of two basic approaches:

Costing a design: - This involves deriving the construction cost of a proposed design and stating the implications to the client and the design team. This approach introduces flexibility into the project budget, as the client may adjust certain aspects of the design to reduce or increase the costs.

Designing to cost: - This implies there is already a set budget, and the design team have to match their designs and concepts to the already stated cost budget. This is the takeoff point for elemental cost planning (Cunningham, 2015).

2.2.1.1 Elemental Cost Planning

This is a method that allows the design team make plans on how the budget will be allocated amongst the component parts of the design. This requires the Quantity Surveyor to carry out comparative cost estimates of different project designs, or parts of a project, in order to identify more economic alternatives. For example, a change in the specifications of tiles and fittings, might adjust the estimated cost, so also with other varied elements of the building.

Elemental cost planning is one of the popular techniques employed to control design costs while still in the evolution stage in the Irish construction industry. This necessitated the arrangement of bills of quantities to the following design elements; Substructure, Superstructure, Roofing, Finishes, Mechanical, Electrical, Fittings, External works.

Each element is allocated a target cost limit, which shall be both reasonable and in proportion to the overall planned cost of the building. The total of the various costs of the elements should not exceed the overall approved budget (Anyanwu, 2013).

According to the various stages of work in the pre-contract - design stage, there are varied process that are carried out in order to achieve the client's stated budget. This process identifies those work items whose costs will be overrun; remedial actions can then be suggested. where required. These procedural steps are outline in the table 2.1 below.

Table 2.1: Stages of work at the in the pre-contract - design stage

S/n	Private Sector	Public Sector
1	Briefing	Confirm approval for design expenditure
2	Feasibility (Order of magnitude cost)	Confirm requirements: Review procurement strategy (Pre-design Review)
3	Outline Proposals (Cost Estimate or Cost Limit)	Assess Project design (Outline Cost plan)
4	Development of Scheme Design (Cost Plan)	Assess project prior to statutory approval (Cost Plan)
5	Production Information (Cost Checking)	Assess Outcome from statutory approval (Cost Checking)
6	Bill of Quantities (Cost Checking)	Approve detailed design solution; review pre-tender cost check; review risk (Pre-Tender Cost checking)
7	Tender action (Cost Analysis)	Review tender returns in advance of awarding the contract (Cost Analysis)

Source: (Cunningham, 2015)

In maintaining a budget within the set target, the Q.S has at his/her disposal some strategies and techniques, which include:

2.2.1.2 Selection of appropriate procurement options

Selecting appropriate method for procuring a project remains a vital decision in the management of project costs. This is because the probability of occurrence of cost overruns has been linked with the procurement method and form of contract adopted. For example, a design-build arrangement which employs competition in both the design and price, often presents the cheapest pathway. The contractor is expected to develop the design with the client's budget (design to cost), any alterations from the clients comes as variations. At the other end, Management contracting and Construction Management techniques lay emphasis on quality and speed, which are often achieved at additional costs. The control and certainty of costs are optimized when the client's work requirements are fully detailed prior to seeking tenders from contractors. Conversely, it is compromised where the bills of quantities include a significant portion of works whose quantities are unknown or uncertain (provisional sums, provisionally measured works and prime cost sums).

2.2.1.3 Budgetary Control

Budgets represent the boundaries within which the design must be carried out. Design options which fall outside these boundaries may need to be readjusted. Otherwise the client might provide allowance for additional resources to accommodate the design (Anyanwu, 2013). Controlling the budget and implementing the budget, helps to make savings in certain aspect of the buildings, thereby providing more resources for other areas. Figure 2.1 shows the budgetary control at the design stage for a building/construction work.

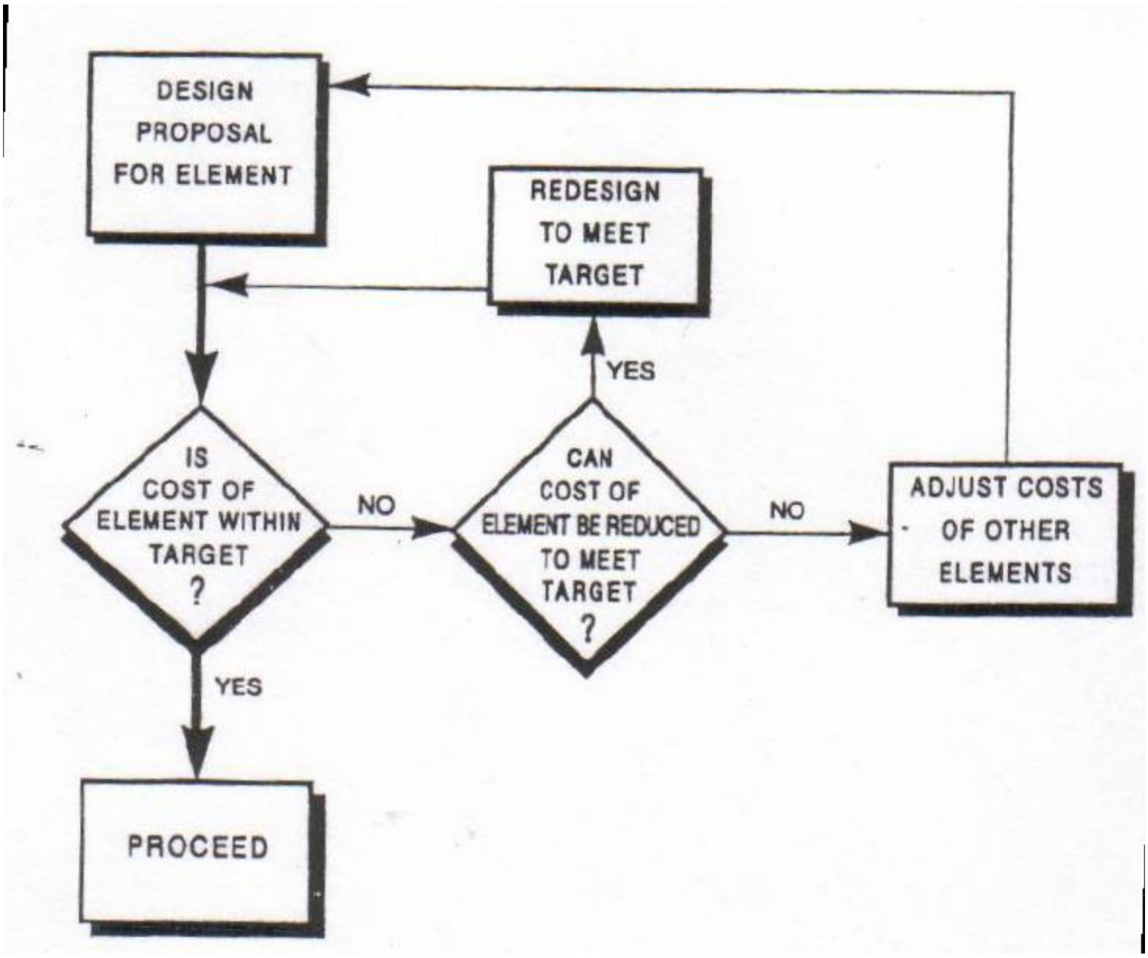

Figure 2.1 shows the budgetary control at the design stage for a building/construction work.
Source: (Cunningham, 2015)

2.2.1.4 Controlling the Consultants

The cost of a project is determined mainly by the type of design adopted; this is turn is usually a result of the people engaged as project consultants. A useful cost control system will involve making sure that the design decisions are made within the overall budgetary boundaries. It is therefore paramount that the consultants proffer solutions in accordance to the budgetary allocations. Designers generally aim for the best possible solution; this might be neither the most economical solution, nor one that lies within the boundaries of the project budget. Thus the cost manager must react always be on hand to advise on the cost implications of the designs (Cunningham, 2015).

2.2.1.5 Project/ Site Meetings

A construction project relies on a heavy inflow of information, a dearth in communication mostly results to assumptions and low quality decisions. Project meetings provide an interface between project stakeholders, especially clients and designers. Design team meetings are also crucial for the design development process. At such meetings the cost manager can present the cost situations and other information that will guide the design team in making effective decisions. The QS must use the opportunity provided by these meetings to update the team on the project's financial status, as well as maintain financial discipline by ensuring that other consultants, for whom costs may not be a main priority, continue to work within the project budget (Cunningham, 2015).

2.2.1.6 Provision of Contingency/ Risk management

The provision of a margin for error in the budget in the early stage of a project is called a design development contingency. The design process should be flexible and realistic enough to cover for certain contingencies that might come up. The amount of contingency provided is associated with the type of project; new projects require less contingency allowance than refurbishment projects. Contingency allowances also reduce as the amount of detail about proposed works increases.

Contingency allowances for projects may be calculated in a variety of ways. Generally however, these have to do with the size and complexity of the project. With low value and low complexity projects, it is usually sufficient that risk management is made a constant item on the agenda at design team meetings. Where high value and low complexity projects are concerned, apart from constantly discussing risk management at meetings, a formal risk register needs to be generated. Such a risk register will detail the nature of each risk in terms of probability, severity and frequency, and suggest a strategy for dealing with each risk (Cunningham, 2015). High value and high complexity projects will require not only the meeting agenda and formal risk register; there is also the need for a risk management expert not directly involved in the project to organise risk workshops for the project (Anyanwu, 2013).

2.2.1.7 Value Management/ Engineering

Value for money refers to the optimum balance between a project's benefits and the client-borne costs. This balance is arrived at through a series of systematic activities that occur through the project cycle, focused on maximizing value for money. The people involved are the client, design team and independent consultants. The aim is to identify the most economic solutions which meet the client's objectives without reducing the functionality of the building.

The VfM process reappraises each aspect of the project in order to reduce capital, running or maintenance costs. This could be achieved through the use of better design or construction techniques, tools or processes. VfM has no effect on necessary costs, but rather attempts to eliminate unnecessary costs before and during constructions.

2.2.2 Cost control techniques at the construction stage

The task of controlling cost at the construction stage is on a new level, as it involves the dynamics of contractors, sub-contractors, and the pulls and push of construction demands. Irrespective of the project planning, unanticipated events will happen; the effect of these could be to render the project's original plan and price obsolete or outdated. Accommodating such unexpected events always add to the original cost of completing the works, Depending on the nature of variation caused, the client mostly bears the costs, sometimes also by the contractors. If the project team will avoid cost overruns, they need to identify the sources of problems and exploits the ability of the cost manager to effectively manage them.

2.2.2.1 Cost value reconciliation (CVR)

This type of cost control technique is favoured by building contractors, because it gives a realistic and accurate financial position of the firm at any current stage, in terms of profitability. It also shows areas of a project that are performing less than profitably, thus providing the chance to take necessary precautionary action to correct the anomaly.

Cost Valuation reconciliation is usually performed on a monthly basis, similar to interim valuation of works; it is carried out by the contractor's quantity surveyor. All of the project team contributes inputs to the process however. This reconciliation may be based on an estimated account and is usually dependent on the quantity surveyor's knowledge and judgement (Obimah, 2018).

2.2.2.2 Contract variance – unit costing

This is the technique preferred by civil and engineering contractors, particularly when there are a few high value components. Each work segment such as concrete works, steel works, ground works, driving piles etc are handled separately and compared with those in the tender. This form of cost report is also carried out on a monthly basis following the interim valuation agreed with the client. The comparison is made between the cost of the work done, and the value of the work itself; the difference between the two is the variance. This helps to record the trends (positive or negative) for better quality decision makings and cost forecast, on the profit and loss on the projects (Obimah, 2018).

2.2.2.3 Earned value analysis

Earned value analysis originated in the US, and was employed mainly for large construction projects. It has become an established method for the evaluation and financial analysis of projects throughout their life cycle. It deals with the control of both the cost and schedule of projects, through the use of trends analysis. The cost-to-schedule variance thus generated by this approach is the popular ‘S’ curve. Earned value analysis requires the calculation of three important values for each activity in the work breakdown structure (Garvin, 2000).

a. The planned value (PV): Also known as the budgeted cost of work scheduled (BCWS), it is defined as the portion of the approved cost estimate planned to be spent on the given activity during a given period.
b. The actual cost (AC): Formerly known as the actual cost of work performed (ACWP), it is the total of costs incurred in accomplishing work on the activity in a given period. The actual cost covers all resources used such as labour, materials, construction equipment and indirect costs.
c. The earned value (EV): this is known as the budget cost of work performed, and is defined as the value of the work actually completed within the given period of time.

This technique provides an effective tool for cost control; this is because it generates a snapshot of the status of the project at any point in time and it is possible to forecast circumstances using hypothetical data.

2.2.2.4 Work breakdown structure (WBS)

Early in the project, when the design is still being done, it is necessary that the designed project is broken down into small, manageable component parts. This is mostly achieved by examining the smallest units of the project that can be delivered by construction trade teams. This deliverable oriented grouping of the work items in project elements generates measurable work packages for cost estimation (Garvin, 2000). An additional benefit of WBS is that it allows all project stakeholders to view project in the same manner in terms of construction process.

2.2.2.5 S-curve

The S-curve has been the iconic face of cost control in construction projects for quite a long time. Given the nature of construction costs, which start slowly, accelerate after a while then begin to slow down again, the graphical depiction of this takes the shape of an S, when costs are plotted against time. Both the S-curve and EVA operate on a similar basis and generate similar output (Garvin, 2000).

2.2.2.6 Monte Carlo simulation

Given the probability and severity of an unexpected adverse event occurring on a construction project, it is possible to use Monte Carlo simulation to statistically model both the cost and duration of an ongoing project. By using such a practical tool, it provides a scientific basis for decisions on size of contingency allowances. It however requires some fairly advanced knowledge to use, although proprietary software packages exist that simplify the use of Monte Carlo simulation for people without advanced knowledge of statistics.

2.2.2.7 Cost forecasting techniques

Cost forecasting techniques enable the project team to predict the costs of a project that has not been constructed; in fact, it is more common for cost forecasting techniques to be used to predict the likely cost of a project that is yet to be designed (Project Management Institute, 2017). Forecasting techniques fall naturally into two major groups, which are: ad hoc forecasting techniques and numerical and statistical forecasting techniques (Hamblin, 2011).

Ad hoc forecasting techniques rely on the experience of the forecaster; there is no need for detailed information, thus these techniques are usually employed quite early in the design period. Examples are rough order of magnitude, expert judgement, rule of thumb and three-point estimates (Saroop & Allopi, 2006).

Numerical and statistical forecasting techniques on the other hand provide more accurate predictions, but they also require hard data or historical data as input. Common examples include moving average, weighted average, linear regression, time series and trend analysis (Chan & Park, 2005). Numerical and statistical techniques have a high reliability rate, since repeated forecasting attempts using the same data will provide identical results. They are however expensive and time consuming to use (Hamblin, 2011).

2.2.2.8 Use of software for cost control

This is becoming more widespread in recent times. Researchers have also been examining how to carry out cost control through the use of software created for project management (Chua et al., 2013). For example, from the study by Liberatore et al. (2001) Primavera Project Planner and Microsoft Project are the most common software employed for project management; the use of software was found to be universal amongst respondents. Other studies have corroborated this view; in Olawale and Sun (2010) Microsoft Project and Primavera Sure Trak also featured prominently. Further development of the use of software has also been reported. Navon (2005) dealt with the use of sensors for data collection, while Costin et al. (2012) and Peyret & Tasky (2003) discussed on Radio Frequency Information Data (RFID) or Global Position System (GPS) applications in cost control.

2.2.2.9 Schedule Monitoring

A construction project is known to be highly dynamic; hence a great need to monitor, to check if everything is going according to plan. Achieving this requires the following information:

a. Establishing if there are variations between estimated and actual commencement of each activity.
b. Establishing if there are variations between the estimated and actual end of each activity.
c. The occurrence, duration and frequency of unplanned events that change the project schedule.
d. Work items that have been executed not in accordance with the planned network sequence
e. Unrealistic milestones and scheduled events (Anyanwu, 2013).

2.2.2.10 Resource Monitoring

Construction projects require three types of resources; labour, materials and equipment. Without proper control and monitoring, the monies spent on these resources will spiral out of control. There are three main common ways through which the use of resources can be monitored and controlled; these are through meetings, inspections and forms.

Meetings provides the opportunity to acquire information quickly, while inspections generate observations on what and how certain resources are used; the use of forms enables the determination and tracking of quantum of resources being consumed in a project. Other benefits of using forms include knowing the cost of the resources used, and keeping a record of the use of resources in the project (Anyanwu, 2013).

2.2.2.11 Budget Monitoring

Monitoring of a project is primarily for ascertaining the level of value added, when present situations are compared to original budgeted plans. Another use of budget monitoring is keeping track of the financial health of the project. This can be achieved through the checking of deviations from plan, either for a single element or the entire project as a whole. Such deviations can occur in any or all of the resources employed on the project. By checking deviations in each work item under the work breakdown structure (WBS) adopted, a picture of the status of the whole project can be generated (Anyanwu, 2013).

2.2.2.12 Material, Equipment and Labour Cost Control

Material control deals with what materials are specified for the project as well as the entire activities involved in obtaining and using such materials. Basically, procuring construction materials relies to a great extent on the material schedule generated for all of the materials required by the works. The purpose of Cost Control focus on material specifically is to ensure the cost of such materials remains within the planned project expenditure budgets. Through report form, purchase order, material requisition forms, invoices, delivery notes, advice notes, waybill notes are official documents needed for material monitoring and control (Anyanwu, 2013).

Carrying out cost control for the use of labour on construction projects can be time-consuming and tedious. Labour time cards are useful in this regard; these cards record the time spent by every tradesman, the work that the tradesman did, and the specific project codes for the work carried out. This system allows a foreman or supervisor to oversee the process; in addition, the man-hours spent on the project can be tracked, labelled and their cost tied to specific tasks. Finally, the differences between actual labour costs and budget allowances for labour (the labour variance) can be established.

Controlling the costs of equipments is similar in procedure to that of labour. Like labour, equipment costs are computed in terms of time for each type of plant. Recording the amount of time any equipment is in use is thus very important. Equipment time cards are used to record the time equipment is in use, the work the equipment was used for, and the project-specific codes for the work thus done. Foremen or supervisors oversee the time recording process, which allows plant-hours to be tied to specific tasks and the equipment variance established (Anyanwu, 2013).

2.2.2.13 Controlling of Sub-Contracts Costs

Similar to controlling material and labour cost control, separate orders are issue for each sub-contracting jobs, it is important that a sub-contractor is conversant with all the ramifications of the requirements of a job before submitting the quotations. This is to reduce the risk of variations and cost overruns. Controlling the sub-contractor cost should be tied to milestones and progress, this helps in preparing payments for work done (Anyanwu, 2013).

2.2.2.14 Controlling Overheads and Indirect Costs

Overheads and indirect costs cannot be divorced from a project, just like for direct costs. Such indirect costs include; Communications, mail office, maintenance, utilities, indirect labour costs, transportations, safety and protection, logistics etc). Keeping records of these costs, and controlling according to the stated budget is vital (Anyanwu, 2013).

2.3 Implementing Cost Control Practices

All stakeholders in the construction industry are affected in one way or the other, almost always adversely, when the costs of projects go over budget: clients, professionals and investors. Akinradewo & Aigbavboa (2019) identified that those cost overruns that arise at the design stage stem mainly from inadequate management of available information amongst the design team. at the construction stage, from factors like economy policies resulting to inflation, variations, and a general poor management of the project.

Maintaining the cost of a construction project within the confines of a budget relies on the use of responsive cost management system; the choice of such a system is determined by a host of factors; how big the company is, work details (building or civil engineering, forms of contract) (Eldash, 2013). A cost control has three major aims, which are:

a. To provide means of comparison between the actual and the budgeted expenses, thereby addressing in a timely manner, the areas deviating from the budget or cost plan
b. Developing a repository of information of the performance of projects in terms of cost.
c. To make it possible to value the changes to the contract and any claims that may arise (Eldash, 2013).

The control of a project's costs is a daunting task, requiring as it does knowledge, expertise and skills on techniques for the control of cost. Therefore construction professionals must have some theoretical understanding of techniques for the control of cost and their application to the elements of a project. Applying a cost control system to a project needs that the cost manager is able to choose the best applicable techniques, apply it at the proper time, and know what to do with the information generated by the application of the cost control techniques thus applied. Malkanthi et al. (2017) have argued that the problem is not a lack of knowledge of cost control techniques, but rather the discipline to strictly apply

such techniques. Their argument appears borne out by the observation by Olawale & Sun (2010) that notwithstanding the large number of software packages available for automating cost control activities, such as Microsoft Project, Asta Power Project, Primavera, cost and time targets are still being missed on many construction projects.
The application of the tools may be use singularly or in combination, while there is argument on the importance of devising formal procedures for administering cost control on projects, the regular, unstructured day-to-day informal activities that concern cost control are even more important. Chigara et al. (2013) drew up three rules for determining the cost effectiveness of a cost control system: running the system should cost less that the benefits realised from the use of the system, results should be delivered in as short a time as possible, and the set up of the system should embrace simplicity rather than complexity.

An effective cost control procedure should have the following attributes:

a. Each construction project must have a budget that includes a contingency allowance;
b. Project costs must be forecasted before making decisions about the design or construction of the project;
c. Expenditure on keeping records of all project costs must not be more than potential savings generated by the system;
d. The deviation of actual costs from forecasted costs should be checked regularly;
e. The reasons for any deviation from forecasted costs should be determined through a variance analysis;
f. The ways in which time and quality affect cost should be considered (Eldash, 2013).

Chigara *et al.* (2013) stated in a study done in Zimbabwe that the problem of cost control is not in the absence of strategies or tools, but in its implementation, as most of the strategies employed in Zimbabwe are those that are universally available.

Aziz et al. (2013) however suggested that professionals take a proactive procedure to control costs by creating and implementing an effective strategic plan, which should be part of the organization's policy, have a proper project planning and scheduling, effectively and efficiently manage the project site, have frequent meetings- as most of the cost overruns were recorded to arise from the contractor's site management related factors.

Olawale & Sun (2010) observed that the level of implementation of cost control techniques was overwhelming in UK (84% of the respondents); the predominant techniques employed were also found to vary widely but included; cost-value appraisal, project profit and loss calculation, profit and loss at valuation dates, unit costing and earned value analysis.

However, in Lesotho, Africa, awareness of cost control appears to be a challenge; majority of the respondents in a study done by Molatseli et al. (2015) claimed not to understand what cost control means.

In Nigeria, Ojedokun et al. (2012) it was observed that all of the respondents in the study, understood cost control systems during construction, and also carry out the procedures, preparing the project cost control report predominantly in quarterly and monthly intervals.

In another study of Otim et al. (2015), the problem of cost control was found to be an absence of technical knowledge and generally poor management of the construction process. In addition, the site workers are not made aware of the performance targets, thereby leading to a frustration of efforts on implementing the cost control practics.

2.4 Problems Encountered during Implementation of Cost Control Practices

Controlling the cost of a project is one of the most difficult of project management tasks usually carried out by contractors and professionals, and the benefits not fully enjoyed (Adejei et al., 2017). The following are problems encountered during the implementation of cost control in building construction;

2.4.1 Using out-dated techniques

This is described as the process where construction professionals in charge of managing project costs rely on analogue technology such as calculators, notebooks, and writing pads to record and analyse costs. This is as opposed to the use of modern ICT technologies that can be applied to the same purpose (Adejei *et al*, 2017).

2.5.1 Limitation of past experiences on new projects

In a world of every changing trend, continuous organization learning and new methods of construction, a reliance on past work experience, methods and estimation fail to solve the present situation of cost variance (Adejei *et a.l*, 2017).

2.4.2 Lack of technical know-how

Effective use of cost control requires both technical and managerial knowledge; where one of these is absent the effectiveness of the system is reduced. To remain competitive and innovative, every construction firm must acquire, manage and apply knowledge of how to control the costs of construction projects (Adejei *et a.l*, 2017).

2.4.3 A lack of suitable cost control process for the firm

Each organization is distinct in mode of operations, goals, objectives, culture, resources and work needs. Failing to develop a cost control template that will best suits the organization, has been described as a square peg in a round hole (Adejei *et a.l*, 2017)..

2.4.4 Difficulty in monitoring the varied sources of day to day cost data

A construction project relies on a daily/ intervals heavy inflow of data, materials inventories, labour reports, invoices, procurement orders and so on, keeping record and update with all of these information can be difficult, especially for small and medium firms, and this data becomes the facts needed to make up the cost data, future estimates and variances (Adejei *et a.l*, 2017).

2.4.5 Variations in contract

A change in design, contract scope, specification, work methods, conditions of site implies additional or a change in costs estimated and budgeted for. This makes controlling the budgeted cost difficult, as a new estimate and cost plan may have to be formulated (Adejei *et a.l*, 2017).

2.4.6 Delayed/ No payments for works done

Every contractor seeks to remain in business, a delay or lack of payment reduces the cash flow, and capacity of the contractor to do more work, there by delaying the contract, increasing overhead costs, wastage of materials and ultimately project abandonment (Adejei *et a.l*, 2017).

2.4.7 Unavailability of cost data

Cost data like, prices of materials, labour cost, inflation index, present value of money, forex index, are very vital to estimating cost forecasting, and valuations of works. A lack of these data means, arriving at a realistic estimate and forecast will be hard or impossible.

2.4.8 Lack of keeping records of site performance

Record of works done, materials purchased, cash received and spent, equipment costs, overhead costs are necessary for knowing the financial status of the project and the firm. This aids to identify if the budget is been exceeded.

2.4.9 Unstable prices of construction materials

Construction materials have been noted to consume a considerable amount of a project costs, an unforeseen change in the price of certain materials like cements, reinforcements, timbers and so on, have a high effect on the total cost of the project, when prices change without been forecasted for, controlling it becomes hard.

2.4.10 Lack of details in designs

Cost estimates and financial forecast are majorly made on the available designs, as the quantity surveyor cannot measure for things not seen. A deficiency in details in design leaves the cost engineer in the dark, thereby making cost control difficult to achieve.

2.4.11 Unstable market / economy conditions

An unstable market and economy condition makes cost forecasting and estimating difficult. The prices of materials can change in an instant, leaving the previous estimate redundant. Same also with increase the costs of construction after the estimates have been made.

2.4.12 Late / No involvement of QS in the construction process

A quantity surveyor is the professional responsible for making cost estimates and forecasting, involving a QS in the project, helps to identify the various cost implications. In simpler words, the bulk of the controlling cost lies on the professional shoulders of the Q.S. involving the professional late or not involving him, is highly detrimental to any process of cost control.

2.4.13 Lack of professional training on Cost Control practices

Cost control is best achieved by selecting the right man with the right skills, for the right job, the right equipment and tools for the right work and the right quality of materials, in the right quantity. These criteria require professional training and learning, a lack in this expertise makes cost controlling hard.

2.4.14 Complexity of the project

Construction projects may become complex presenting a challenge for an effective cost control, especially when not envisioned in the designing and planning stage. This increases the negativity effect in controlling the costs (Olawale & Sun, 2010).

2.4.15 Unstable government regulations

A government regulation can increase or decrease the price of materials and labour. The uncertainty of these policies makes it difficult for the managers to make forecast or control the cost base on the budget.

2.4.16 Choice of contract procurement methods

The choice of the contract procurement determines how the nature and methodology in which the project will be executed. For example a design and build contractor is expected to develop the design with the client's budget (design to cost), any alterations from the clients comes as variations. Management contracting and Construction Management techniques emphasise quality and speed, which invariably increases project costs (Sanni & Hashim, 2013).

2.4.17 Risk and uncertainties

Risks and uncertainty are related, and have been noted to have adverse effects on delivery of construction projects. Construction works are highly dynamic, thereby making it a risky business. The occurrences of site accidents, force majeure, inflations, change in materials prices etc makes controlling cost difficult (Olawale & Sun, 2010).

2.5 The Relationship between Implementation of Cost Control Practices and Cost Performance of Construction Projects

The efficacy of cost control can be revealed by the achievement of cost control goals. One of which is to keep a project within the stated budget. Gaining a maximum profit on schedule and within the budget, keeping the total expenditure within the initial estimated budget, giving the client a good value for money and achieving a balanced distribution of project funds with other elemental parts of the building (Hwang et al., 2018).

Malkanthi *et al.* (2017) observed that there is a positive relationship between cost control process and the cost of project overheads. It is believed that about 50% of overhead costs can be reduced using proper techniques. In another study Adebayo, Eniowo & Ogunjobi (2018), cost monitoring and control was stated to be effective in identifying potential cost overruns, mitigating unfavourable variations in project costs, and delivering projects within budget.

By using alternative materials in an attempt to control costs, as well as maintaining the quality, creating a safety plan specific to the project, training on ongoing activity of project to all employees, monitoring, evaluating and adjusting as the work progress daily, proper safety measures to prevent accidents, a residential building was observed to be reduced by 3.5% of the planned cost budget (Kokate & Darade, 2018).

Matins (2018) also iterates that, value will be increased and granted to the client by removing unnecessary costs to the project or using a technique that would decrease the cost of owning and operating a facility (life-cycle costing). A summary of these impacts was revealed in the study in the Table 2.2.

Table 2.2: Impact of cost control on construction projects

Country	Project Name	Category	Cost	Percentage Cost saved	Cost saved
USA	Pink House Curve	Infrastructure	$3,669,000.00	28.22%	$1,600,000.00
	West Bank Road	Infrastructure	$786,000.00	12.09%	$95,000.00
China	34 Mile Highway	Infrastructure	$171,255,600..00	6.30%	$10,789,102.80

	Underground Railway	Infrastructure	$307,424,000.00	3.50%	$17,759,640.00
U.A.E	ADNOC Group of Companies Headquarters	Commercial	$144,980,000.00	11.16%	$16,180,000.00
	RUWAIS Housing Complex Expansion – Phase III New Hospital and Related Facilities	Instution	$75,776,682.00	8.64%	$6,549,430.00
UK	Home Happening	Residential	$203,516,640.00	1.22%	$2,472,907.00
	Open University Library	Institution	$24,025,760.00	7.65%	$1,837,017.00

Source: Matins (2018)

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design and Method

The type of research design chosen by a researcher gives an indication of the emphasis he/she places on the process of the research (Bryman, 2017). In other words, a research design is how the researcher arranges to collect the information that will be used to prove or disprove the position adopted by the research. The method adopted in any research encompasses all of the different techniques that can be employed in research (Kothari, 2004). There are three major worldviews that a research can belong to; these are the qualitative paradigm (interpretive), the quantitative paradigm (positivist) and the mixed paradigm (pragmatism). This research employed a quantitative approach that was based on the use of well-structured questionnaires.

3.2 Research Population

According to Webster (2018), population can be viewed as the entire number of people or inhabitants in a country or region .it is also referred to as the complete set of case or element from which a sample is taken (Bryman, 2017). A population have some characteristics, which are:

a. Homogenous: Similar sets of persons

b. Stratified: Classifications of individuals in different levels

c. Grouped by type /Location: individuals/ persons that exist in a particular geographical area or kind of work (Walliman, 2011).

The population for this research work was construction professionals working in the Federal Ministry of Works, Housing and Power, Federal Road Maintenance Agency, Federal Road Safety Corps, Dantata & Sawoe, Julius Berger and OBGT Consult all located in Abuja, Federal Capital Territory.

3.3 Sampling Frame

This is the representation of the individuals who have a chance to be captured among the selected sample procedure (Adwok, 2015). A sampling frame serves as a container of the population, out of which researchers can now apply any of the applicable methods to select the sample that they will work with (Elder, 2009). For this study the sample frame was made up of the construction professionals working in the selected Private sector & Public sector (MDAs) within Abuja.

3.4 Sample Size

This is the small part of the whole population, captured to represent the characteristics of the whole population (Walliman, 2011). Sample size has a statistical relationship to the entire population which is used to compute the representativeness of the sample as well as determine the accuracy and reliability of any findings obtained from the sample (Zamboni, 2017).

For the purpose of this research, a census of the entire construction professionals in the selected Private sector & Public sector (MDAs) within Abuja. However, despite repeated visits to the selected sectors, the figures in Table 3.1 represented the numbers of professionals that were actually accessed and sampled. A total of 65 construction professionals that had been involved in construction works and services were sampled.

Table 3.1: Sample size obtained for the study

Type of professional	Private sector & Public sector agencies (Ministries)			
	Consulting	**Contracting**	**MDAs**	**Others**
Architect	1	5	4	0
Builder	2	7	6	1
Engineer	1	3	4	0
Estate Surveyor	0	0	3	0
Quantity Surveyor	3	8	9	1
Town Planner	1	3	3	0
Other (specify)	0	0	0	0
Totals	**8**	**26**	**29**	**2**

Source: Researcher's fieldwork (2019)

3.5 Sampling techniques

This is the technique employed in sourcing data from the selected sample size and it can be split into two basic groups of techniques which are: Probability and Non-probability sampling techniques (Walliman, 2011).

Simply defined, probability sampling techniques rely on a known distribution (usually the normal distribution) to extract sample elements from a population. This means that the resulting sample represents the characteristics present in the population, because every member of the population has been given an equal chance of being selected. With non-probability sampling techniques, the judgement of the researcher is paramount; a section of the population is selected based on the training, skill and experience of the researcher, all of which are difficult to replicate (Walliman, 2011).

This study employed the use of simple random sampling technique; the various locations where respondents were surveyed were picked randomly, in no particular order. This is a method of sampling that ensures that every member of the population is given an equal chance of being selected (Morenikeji, 2006). Questionnaires were served until 230 members of the population had been reached. However only 65 of the questionnaires were eventually retrieved, and being found completely and corrected filled in, were used in the analysis of data. This meant that the response rate for the study was 28.26%; this low response rate was attributed to the nature of the construction industry, where situations are dynamic, and it is difficult to pin respondents down for any length of time.

3.6 Instrument for Data Collection

The study first employed the use of existing literatures as secondary source to the identify the cost control practices applied on construction project sites, past level of implementation of the cost control practices, problems encountered during the implementation of cost control on building project and the relationship between implementation of cost control practices and performance of building projects.

Thereafter, a structured questionnaire with a 5 Likert scale was designed and administered to the proportionate sample size within the study area. The questionnaire was made up of four sections. The first section (Section A) dealt with the demographics of the respondents. Section B focused on cost control practices applied on construction sites, while Section C dealt with the level of implementation of the practices. Section D collected information on the barriers that impeded the application of the practices.

The research instrument was developed in consultation with the research supervisor for this study. Its reliability was also reviewed and validated by other seasoned researchers within the Department of Quantity Surveying before it was allowed to be taken out to the field for general application.

3.7 Method of Data Analysis and Presentation

The data accumulated was analysed in accordance to the respective objectives of the study, using descriptive statistical methods (Relative importance index, Ranking Method, Mean Item Score). Spearman’s Rank Correlation and Analysis of Variance (ANOVA) were employed in the analysis of data relating to the fourth objective of the study. The analysed data was presented with the aid of tables, bar charts, and graphs, to aid proper understanding. Table 3.2 shows the arrangement of the objectives and the corresponding analysis and presentation techniques.

Table 3.2: Procedures for treating the research objectives

s/n	Objectives	Data Tools	Method of Analysis
1	To identify the cost control practices applied on building project sites in the study area	Questionnaire	Mean Item Score and Ranking Method; ANOVA
2	To determine the level of implementation of the applied cost control practices.	Questionnaire	Relative Important Index and Ranking Method; ANOVA
3	To examine the problems encountered during the implementation of cost control on building project sites	Questionnaire	Relative Important Index and Ranking Method
4	To determine the relationship between implementation of cost control practices and performance of building projects	Questionnaire	Spearman's Rank Correlation; ANOVA

Table 3.2 Researchers' Construct, 2019

3.7.1 Percentile method

Percentage helps in rating a number of variables. Percentage is used to show the size of the respondents who had the same opinions and those that had conflicting opinions. It involves obtaining the proportion of response to a particular option by a respondent to the total number of respondents, these being expressed as percentages. The option having the largest number of responses was considered as representing the majority upon which the final conclusion to the question was based. The percentile was used in analysing demographic characteristics of the respondents.

3.7.2 Pearson product-moment correlation

This statistical technique was employed to determine the relationship between the two variables. Correlation study is concerned with measuring the degree of relationship between two or more variables for the purpose of making predictions about relationships.

Correlation study indicates if an association exists, it does not indicate causation. That is, if A and B are related, it does not necessarily mean that A causes B.

Pearson product-moment correlation coefficient (r) was used in assessing the level of association or strength of relationship between two variables when the raw data are available in absolute values. Its value ranges from -1.0 to + 1.0. In order for the scores for the two variables to be highly correlated, the calculated value of 'r' has to be large tending towards + 1 or -1. The correlation coefficient (R) is calculated using the formula.

$$r = n\,\frac{n(\sum XY - (\sum X \sum Y)}{\sqrt{(n \sum X2 - (\sum X)2(n \sum Y2 - (\sum Y2)}}$$

The tests were taken at 5% level of significance. The basis of decision is on the premise below:

Correlation coefficient	**Nature of relationship**
0.00 to 0.03 (0.00 to 0.30)	Weak correlation
0.30 to 0.50 (-.30 to -.50)	Low positive (negative) correlation
0.50 to 0.70 (-.50 to -.70)	Moderate positive (negative) correlation
0.70 to 0.90 (-.70 to -.90)	High positive (negative) correlation
0.90 to 1.00 (-.90 to -1.0)	Very high positive (negative) correlation

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Analysis of Respondents' Demographics

Table 4.1 revealed the demography of the respondents in respect to their profession, educational attainment, gender and number of workers. The respective professions and their frequency and percentage are Architect- 4 (6.2%), Builders – 8 (12.3%), Engineers- 11 (16.9%), Quantity Surveyor – 25 (38.5%), Town Planner – 9 (13.8%), and others which was 0 (0%).

Table 4.1 Respondents Characteristics

Demographic variable		Frequency	%
Profession	Architect	4	6.2
	Builder	8	12.3
	Engineer	11	16.9
	Estate Surveyor	8	12.3
	Quantity Surveyor	25	38.5
	Town Planner	9	13.8
	Other (specify)	0	0.0
	Total	65	100.0
Educational attainment	OND/NCE	9	13.8
	HND/B.Sc	38	58.5
	M.Sc	18	27.7
	Ph.D	0	0.0
	Other (specify)	0	0.0
	Total	65	100.0
Gender	Female	13	20.0
	Male	52	80.0
	Total	65	100.0
Size of organization	Less than 50	29	44.6
	50 – 250	24	36.9
	More than 250	12	18.5
	Total	65	100.0

Researchers' Findings, 2019

The educational level attained are as follows; 9 (13.8%) of the total respondents had OND/NCE, 38 (58.5%) had HND/B,Sc, 18 (27.7%) had M.Sc, while 0 (0%) had Ph.D and others. The gender as indicated by the table, reveals that 13 (20%) were females, while 52

(80%) were males. The results also revealed that 29 (44.6%) of the total respondents worked in organizations that had less than 50 workers; 24 (36.9%) respondents worked in organizations that had an average of 50 -250 workers, while 12 (18.5%) were in organizations that had more than 250 workers.

Table 4.2 represents the organizations characteristics, classified into type of organization, Work experience of respondents and type of works handled. This is to reinforce the authenticity of the data sourced from the respondents. The type of organizations is distinguished as follows; Consulting firms were 8 (12.3%), Contractors 26 (40.0%), Client Organizations 0 (0), Ministries, Departments of works and Agencies (MDAs) 29 (44.6%), Academic Institutions 0 (0%), and others 2 (3.1%).

Table 4.2 Organization's Characteristics

Demographic variable		Frequency	%
Type of organization	Consulting firms	8	12.3
	Contractor	26	40.0
	Client organization	0	0.0
	Ministries, Department, Agencies (MDAs)	29	44.6
	Academic institutions	0	0.0
	Others	2	3.1
	Total	65	100.0
Work experience of respondents	Less than 5 yrs	0	0.0
	5 yrs – 15 yrs	20	30.8
	16 yrs – 25 yrs	27	41.5
	More than 25 yrs	18	27.7
	Total	65	100.0
Type of works handled	Building	38	58.5
	Civil engineering	2	3.1
	Building and Civil engineering	25	38.5
	Others	0	0.0
	Total	65	100.0

Researchers' Findings, 2019

The work experience of respondents revealed that no respondent had worked for less than 5 years; 20 respondents (30.8%) had worked for 5 – 15 years, while 27 respondents (41.5%) had worked for 16 – 25 years. The types of work handled are as follows and their respective frequencies; Building works were 38 (58.5), Civil Engineering 2 (3.1%), Building and Civil Engineering 25 (38.5%).

4.2 Identification of Cost Control Techniques applied on Construction Projects

This section of the chapter dealt with the analysis of data for the achievement of Objective One of this study as stated in Chapter One. Primary data collected through self-administered questionnaires on the cost control techniques applied on construction projects were analysed using descriptive techniques such as Mean Score and Analysis of Variance (ANOVA). The ANOVA was used to test whether the work experience of respondents, type of works carried out as well as the size of the firms had any influence on the cost control techniques that were mostly applied by the respondents.

There were eighteen cost control techniques tested in all, as presented in Table 4.3; the three highest ranked techniques were (i) Controlling of Sub-contracts costs – MS = 4.49; (ii) Contract Variance – Unit Costing – MS = 4.48; and (iii) Cost Reports – MS = 4.43. The techniques of carrying out cash-flow analysis and preparing work programmes did not appear to be widespread, as it was only ranked 9th (MS = 4.05; it however corresponded to 'high extent' on the Likert scale employed in the research questionnaire. Going by the ranking, the least applied technique was the use of 'Use of S-curve for cost/time monitoring', which had a MS of 2.14.

Table 4.3: Level of Implementation of Cost Control Techniques

ID	Cost control techniques	Mean Score	SD	RII	Rank	Extent of application
2.1	Budget Monitoring	4.26	0.73	0.85	6	High Extent
2.2	Cash-flow analysis and work programmes	4.05	0.60	0.81	9	High Extent
2.3	Contract Variance – Unit Costing	4.48	0.50	0.90	2	High Extent
2.4	Controlling of Sub-contracts costs	4.49	0.56	0.90	1	High Extent
2.5	Controlling Overheads and Indirect Costs	4.18	0.46	0.84	7	High Extent
2.6	Cost estimating and budgeting	4.11	0.92	0.82	8	High Extent
2.7	Cost Forecasting techniques	3.97	0.71	0.79	11	High Extent
2.8	Cost Reports	4.43	0.56	0.89	3	High Extent
2.9	Cost Value Reconciliation (CVR)	3.83	1.11	0.77	13	High Extent
2.10	Earned value analysis (EVA)	3.37	1.01	0.67	16	Moderate Extent
2.11	Control of material, equipment and labour costs	4.32	0.79	0.86	5	High Extent
2.12	Monte Carlo simulation of project costs	3.71	0.68	0.74	14	High Extent
2.13	Resources management related strategy	3.97	0.73	0.79	10	High Extent
2.14	Schedule Monitoring	4.40	0.66	0.88	4	High Extent
2.15	Use of S-curve for cost/time monitoring	2.14	1.18	0.43	18	Low Extent
2.16	Use of software for cost control	2.35	1.28	0.47	17	Low Extent
2.17	Variance analysis	3.65	0.69	0.73	15	High Extent
2.18	Work Breakdown Structure (WBS)	3.88	0.65	0.78	12	High Extent

Researchers' Findings (2019)
Key: SD=Standard Deviation; RII=Relative Importance Index

4.2.1 Influence of work experience on respondents' perception of cost control techniques application

Analysis of variance (ANOVA) tests were carried out to determine whether the different years of work experience of respondents influenced them to perceive the applications of cost control techniques in different ways. The result of the ANOVA was reported in Table 4.4. Only 20 respondents selected options in the part of the research instrument that dealt with this section. Only in thirteen out of 18 techniques was this presumption found to be true; this was where the 'Sig.' value of the analysis was lower than the statistical threshold of 0.05. These included the three highest ranked techniques, which were ((i) Contract Variance – Unit Costing; (ii) Budget monitoring; and (iii) Resource Management strategy.

Table 4.4 Determination of Cost Control Techniques Based on the Work Experience of the Respondent

Cost control techniques	N	Mean values: 5 yrs – 15 yrs	16 yrs – 25 yrs	More than 25 yrs	All groups	df1	df2	F	F0.05	Sig.	Remark
Budget Monitoring	20	4.50	3.74	4.78	4.26	2	62	19.298	3.150	.000	SS
Cash-flow analysis and work programmes	20	3.90	4.04	4.22	4.05	2	62	1.399	3.150	.254	NS
Contract Variance – Unit Costing	20	4.00	5.00	4.22	4.48	2	62	130.575	3.150	.000	SS
Controlling of Sub-contracts costs	20	4.70	4.30	4.56	4.49	2	62	3.345	3.150	.042	SS
Controlling Overheads and Indirect Costs	20	4.10	4.22	4.22	4.18	2	62	.472	3.150	.626	NS
Cost estimating and budgeting	20	4.55	3.70	4.22	4.11	2	62	5.805	3.150	.005	SS
Cost Forecasting techniques	20	3.60	4.00	4.33	3.97	2	62	5.944	3.150	.004	SS
Cost Reports	20	4.70	4.30	4.33	4.43	2	62	3.667	3.150	.031	SS
Cost Value Reconciliation (CVR)	20	3.10	3.74	4.78	3.83	2	62	16.091	3.150	.000	SS
Earned value analysis (EVA)	20	3.10	3.15	4.00	3.37	2	62	5.576	3.150	.006	SS
Control of material, equipment and labour costs	20	3.70	4.70	4.44	4.32	2	62	13.093	3.150	.000	SS
Monte Carlo simulation of project costs	20	3.45	3.93	3.67	3.71	2	62	3.058	3.150	.054	NS
Resources management related strategy	20	3.65	3.74	4.67	3.97	2	62	17.405	3.150	.000	SS
Schedule Monitoring	20	3.95	4.63	4.56	4.40	2	62	8.445	3.150	.001	SS
Use of S-curve for cost/time monitoring	20	1.95	1.63	3.11	2.14	2	62	11.790	3.150	.000	SS
Use of software for cost control	20	2.50	1.59	3.33	2.35	2	62	14.453	3.150	.000	SS
Variance analysis	20	3.75	3.48	3.78	3.65	2	62	1.319	3.150	.275	NS
Work Breakdown Structure (WBS)	20	3.95	3.67	4.11	3.88	2	62	2.868	3.150	.064	NS

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.2.2 Influence of kind of works executed on respondents' perception of cost control techniques application

ANOVA test was also carried out to determine if the kind of works executed by the firms have an influenced on the cost control techniques chose, and the result was reported in

Table 4.5. Only 38 respondents selected options in the part of the research instrument that dealt with this section. Only Six (6) out of the eighteen (18) techniques were influenced by the kind of work carried out by the respondents' organizations, where the 'Sig.' value of the analysis was lower than the statistical threshold of 0.05. The highest ranked techniques were earned value analysis (EVA), cash-flow analysis and work programmes and Work breakdown structure. In each of the cases, the values differ proportionally across the nature of works, no comparison studies were found stating the influence of type of work on the choice of cost control techniques.

Table 4.5 Determination of Cost Control Techniques Based on the Kind of works handled

Cost control techniques	N	Mean values: Building	Civil engineering	Building and Civil engineering	All groups	df1	df2	F	F0.05	Sig.	Remark
Budget Monitoring	38	4.05	4.00	4.60	4.26	2	62	4.831	3.150	.011	SS
Cash-flow analysis and work programmes	38	4.29	4.00	3.68	4.05	2	62	10.071	3.150	.000	SS
Contract Variance – Unit Costing	38	4.45	4.00	4.56	4.48	2	62	1.317	3.150	.275	NS
Controlling of Sub-contracts costs	38	4.61	4.00	4.36	4.49	2	62	2.316	3.150	.107	NS
Controlling Overheads and Indirect Costs	38	4.16	4.00	4.24	4.18	2	62	.392	3.150	.678	NS
Cost estimating and budgeting	38	3.92	4.00	4.40	4.11	2	62	2.127	3.150	.128	NS
Cost Forecasting techniques	38	3.92	4.00	4.04	3.97	2	62	.210	3.150	.811	NS
Cost Reports	38	4.39	4.00	4.52	4.43	2	62	.994	3.150	.376	NS
Cost Value Reconciliation (CVR)	38	3.61	4.00	4.16	3.83	2	62	1.957	3.150	.150	NS
Earned value analysis (EVA)	38	2.92	4.00	4.00	3.37	2	62	12.181	3.150	.000	SS
Control of material, equipment and labour costs	38	4.11	4.00	4.68	4.32	2	62	4.600	3.150	.014	SS
Monte Carlo simulation of project costs	38	3.50	4.00	4.00	3.71	2	62	4.797	3.150	.012	SS
Resources management related strategy	38	3.82	4.00	4.20	3.97	2	62	2.178	3.150	.122	NS
Schedule Monitoring	38	4.50	4.00	4.28	4.40	2	62	1.238	3.150	.297	NS
Use of S-curve for cost/time monitoring	38	2.03	3.00	2.24	2.14	2	62	.786	3.150	.460	NS
Use of software for cost control	38	2.24	3.00	2.48	2.35	2	62	.527	3.150	.593	NS
Variance analysis	38	3.74	4.00	3.48	3.65	2	62	1.312	3.150	.277	NS
Work Breakdown Structure (WBS)	38	3.66	4.00	4.20	3.88	2	62	6.134	3.150	.004	SS

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.2.3 Influence of size of organization on respondents' perception of cost control techniques application

The influence of the size of organization on respondents' perception of the application of cost control techniques was shown in Table 4.6, using ANOVA tests. Only 29 respondents selected options in the part of the research instrument that dealt with this section. The application of thirteen (13) out of the eighteen (18) techniques were considered by respondents as being influenced by the size of organizations; this was where the 'Sig.' value of the analysis was lower than the statistical threshold of 0.05. The highest ranked techniques included Cost reports, Use of software for cost control, and Use of S-curve for cost/time monitoring.

Table 4.6 Determination of Cost Control Techniques Based on the Number of Employees

Cost control techniques	N	Mean values: Less than 50	50 - 250	More than 250	All groups	df1	df2	F	F0.05	Sig.	Remark
Budget Monitoring	29	4.03	4.50	4.33	4.26	2	62	2.863	3.150	.065	NS
Cash-flow analysis and work programmes	29	4.24	3.83	4.00	4.05	2	62	3.330	3.150	.042	SS
Contract Variance – Unit Costing	29	4.72	4.33	4.17	4.48	2	62	8.293	3.150	.001	SS
Controlling of Sub-contracts costs	29	4.48	4.67	4.17	4.49	2	62	3.407	3.150	.039	SS
Controlling Overheads and Indirect Costs	29	4.00	4.50	4.00	4.18	2	62	11.732	3.150	.000	SS
Cost estimating and budgeting	29	3.45	4.71	4.50	4.11	2	62	23.018	3.150	.000	SS
Cost Forecasting techniques	29	3.86	3.92	4.33	3.97	2	62	2.060	3.150	.136	NS
Cost Reports	29	3.93	5.00	4.50	4.43	2	62	96.125	3.150	.000	SS
Cost Value Reconciliation (CVR)	29	4.24	2.92	4.67	3.83	2	62	22.553	3.150	.000	SS
Earned value analysis (EVA)	29	3.07	3.25	4.33	3.37	2	62	8.572	3.150	.001	SS
Control of material, equipment and labour costs	29	4.38	4.25	4.33	4.32	2	62	.171	3.150	.843	NS
Monte Carlo simulation of project costs	29	3.45	3.96	3.83	3.71	2	62	4.385	3.150	.017	SS
Resources management related strategy	29	3.76	4.04	4.33	3.97	2	62	3.009	3.150	.057	NS
Schedule Monitoring	29	4.59	4.29	4.17	4.40	2	62	2.344	3.150	.104	NS
Use of S-curve for cost/time monitoring	29	1.86	1.63	3.83	2.14	2	62	28.529	3.150	.000	SS
Use of software for cost control	29	1.97	1.83	4.33	2.35	2	62	38.215	3.150	.000	SS
Variance analysis	29	3.38	3.54	4.50	3.65	2	62	17.353	3.150	.000	SS
Work Breakdown Structure (WBS)	29	3.83	3.71	4.33	3.88	2	62	4.243	3.150	.019	SS

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.3 Level of Implementation of Cost Control Techniques and Practices

This section addresses the Objective two of this study as stated in Chapter One. Primary data collected through self-administered questionnaires on the level of implementation of the cost control techniques and practices applied on building projects. The frequency of the responses were taken and presented using a graph.

4.3.1 Level of Implementation of Cost Control Practices

Figure 4.1 represents the graphical illustration of the level of implementation of the various cost control practices. The result presented in the chart revealed that approximately 80% of the respondents always conducted variance analysis to determine resources for budget deviations; however 19% sometimes applied variance analysis while 1% of the sample never used it. Slightly more than half of the sample (57%) always compared the actual costs with forecasted budget at consistent decision intervals, while 43% sometimes did so. It was also discovered that 90% of the respondents always set up recording system for the project costs. With respect to 'estimating contingency allowance for project budget', about 79% always carried out this practice, while 60% always forecasted costs for project budgeting.

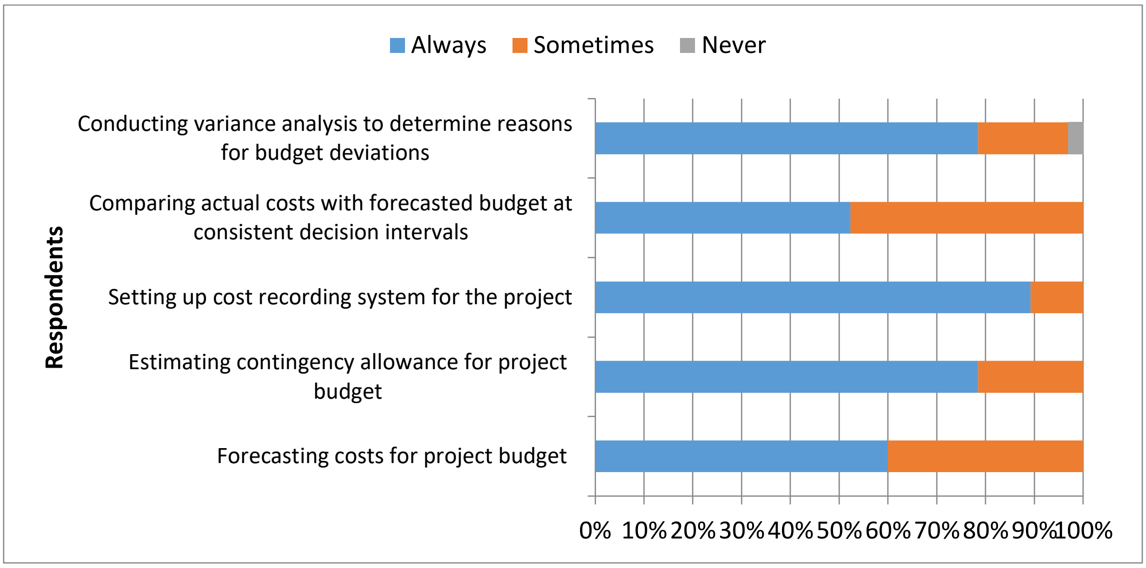

Fig 4.1: Level of implementation of cost control practices

4.3.2 Influence of nature of works handled on respondents' perception of level of implementation of cost control techniques

The results of ANOVA tests that was carried out and presented in Table 4.7 showed the relationship between the nature of works handled and the implementation of cost control practices. Out of the five (5) practices, three (3) were perceived to be significantly associated with the nature of works handled. These three were: (i) estimating contingency allowance for project budget, (ii) forecasting costs for budget, and (iii) comparing actual costs with forecasted budget at constant decisions intervals. The significant association was inferred from the 'sig.' values of the three practices, which were lower than the 0.05 'alpha' threshold. In addition, the values of the 'F-statistic' obtained were higher than the critical value of $F_{0.05}$ at the degrees of freedom shown.

Table 4.7 Relationship between Cost control practices and the nature of works handled

Cost control practices	N	Mean values				df1	df2	F	$F_{0.05}$	Sig.	Remark
		Building	Civil engineering	Building and Civil	All groups						
Forecasting costs for project budget	**38**	**2.42**	**3.00**	**2.84**	**2.60**	**2**	**62**	**7.311**	**3.150**	**.001**	**SS**
Estimating contingency allowance for project budget	**38**	**2.95**	**3.00**	**2.52**	**2.78**	**2**	**62**	**10.860**	**3.150**	**.000**	**SS**
Setting up cost recording system for the project	38	2.95	3.00	2.80	2.89	2	62	1.848	3.150	.166	NS
Comparing actual costs with forecasted budget at consistent decision intervals	**38**	**2.37**	**3.00**	**2.72**	**2.52**	**2**	**62**	**5.210**	**3.150**	**.008**	**SS**
Conducting variance analysis to determine reasons for budget deviations	38	2.63	3.00	2.92	2.75	2	62	2.913	3.150	.062	NS

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.3.3 Influence of size of the company workforce on respondents' perception of level of implementation of cost control techniques

The results of ANOVA tests that was carried out and presented in Table 4.8 showed the relationship between the size of the company workforce and the implementation of cost control practices. Out of the five (5) practices, three (3) were perceived to be significantly associated with the nature of works handled. These three were: (i) estimating contingency allowance for project budget, (ii) setting up cost recording system for the project, and (iii) conducting variance analysis to determine reasons for budget deviations. The significant association was inferred from the 'sig.' values of the three practices, which were lower than the 0.05 'alpha' threshold.

Table 4.8 Relationship between Cost control practices and the number of employees

Cost control practices	N	Mean values				Df	Df	F	F0.05	Sig.	Remark
		Less than	50 – 250	More than	All group						
Forecasting costs for project budget	29	2.48	2.63	2.83	2.60	2	62	2.276	3.150	.111	NS
Estimating contingency allowance for project budget	**29**	**3.00**	**2.67**	**2.50**	**2.78**	**2**	**62**	**9.863**	**3.150**	**.000**	**SS**
Setting up cost recording system for the project	**29**	**3.00**	**2.88**	**2.67**	**2.89**	**2**	**62**	**5.592**	**3.150**	**.006**	**SS**
Comparing actual costs with forecasted budget at consistent decision intervals	29	2.48	2.50	2.67	2.52	2	62	.599	3.150	.553	NS
Conducting variance analysis to determine reasons for budget deviations	**29**	**2.66**	**3.00**	**2.50**	**2.75**	**2**	**62**	**5.741**	**3.150**	**.005**	**SS**

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.4 Problems Hindering the Implementation of Cost Control on Construction Projects

This section of the chapter tackles Objective Three of this study as stated in Chapter One. Primary data collected through self-administered questionnaires on the problems hindering the implementation of cost control on construction projects; these were analysed using Mean Score descriptive technique. The data was categorised in order to test whether the work experience of respondents, type of works carried out as well as the size of the firms had any influence on the problems identified and applied.

The study identified fifteen problems that hinder cost control from literature. The results of the Mean Score analysis and presented in Table 4.9 revealed that the three highest ranked problems were (i) Delayed/ No payments for works done (MS = 4.58); (ii) Late/Non-involvement of QS in the project (MS = 4.58); and (iii) Unstable Government Policies/ Economic Conditions (MS = 4.54). Using out-dated cost control techniques and type of procurement methods were ranked 6th and 7th (MS = 4.49; MS = 4.43 respectively). The problem that was considered least important was ‘Unavailability/inadequacy of cost data’ which had a MS of 4.12.

The range of mean scores obtained showed that respondents agreed that all of the 15 problems were important to some extent. The Standard Deviation (SD) was used to resolve situations where two problems, practices or techniques had the same Mean Score (MS). This was the case with ‘Delayed/ No payments for works done’ and ‘Late / Non involvement of QS in the project’, which both had a MS of 4.58. The size of the SD was then used to assign ranks to each problem. Thus ‘Delayed/ No payments for works done’ was ranked 1, because of its SD of 0.61, while ‘Late / Non involvement of QS in the project’ which had an SD of 0.56 was ranked 2.

Table 4.9 Problems hindering cost control practices

Problems hindering Cost control practices	MS	SD	RII	Rank	Extent of agreement
Delayed/ No payments for works done	4.58	0.61	0.92	1	Strongly agree
Late / Non involvement of QS in the project	4.58	0.56	0.92	2	Strongly agree
Unstable government policies/economic conditions	4.54	0.56	0.91	3	Strongly agree
Variations in Contract	4.52	0.66	0.90	4	Strongly agree
Lack of technical know-how to use available cost control tools	4.49	0.66	0.90	5	Agree
Using out-dated cost control techniques	4.49	0.62	0.90	6	Agree
Type of procurement methods employed	4.43	0.56	0.89	7	Agree
Inadequate recording of site cost data daily from multiple sources	4.40	0.55	0.88	8	Agree
Complexity of the project	4.35	0.54	0.87	9	Agree
Absence of professional cost control training	4.34	0.62	0.87	10	Agree
Limited transferability of past experiences to new projects	4.34	0.59	0.87	11	Agree
Insufficient details in designs	4.32	0.69	0.86	12	Agree
Instability in prices of construction materials	4.29	0.68	0.86	13	Agree
Risk and uncertainties in the construction process	4.22	0.65	0.84	14	Agree
Unavailability/inadequacy of cost data	4.12	0.67	0.82	15	Agree

Researchers' Findings (2019)
Key: MS=Mean Score; SD=Standard Deviation; RII=Relative Importance Index

4.4.1 Problems hindering cost control techniques/practices based on respondent work experience

Table 4.10 revealed difference in agreement on problems affecting cost control practices based on the work experience of respondents. Respondents that have worked for 5 - 15 years ranked 'Variation in contract as the highest problem hindering cost control techniques/practices' with the mean score of 4.80 followed by 'Unstable government policies/economic conditions' (4.70) and 'Late/ Non involvement of QS in the project' (4.55).

Respondents that have worked for 16 – 25 years ranked 'Lack of technical know-how to use available cost control tools' with a mean score of 5.00, followed by 'delayed/no payment for work done' (4.70), and thirdly 'Limited transferability of past experiences to new projects' (4.70).

Finally respondents that have worked for more 25 years ranked 'the type of procurement methods employed', 'complexity of the project' and 'Delayed/ No payments for work done' as 1st, 2nd and 3rd most important problems respectively.

Table 4.10 Determination of the Problems Hindering Cost Control Practices based on the work experience of respondent

Problems hindering Cost control practices	5 yrs – 15 yrs			16 yrs – 25 yrs			More than 25 yrs		
	Mean Score	SD	Rank	Mean Score	SD	Rank	Mean Score	SD	Rank
Absence of professional cost control training	4.40	0.88	7	4.30	0.47	12	4.33	0.49	9
Complexity of the project	4.05	0.51	13	4.30	0.47	13	4.78	0.43	2
Delayed/ No payments for works done	4.35	0.67	8	4.70	0.47	2	4.67	0.69	3
Inadequate recording of site cost data daily from multiple sources	4.45	0.69	5	4.41	0.50	10	4.33	0.49	8
Instability in prices of construction materials	4.50	0.69	4	4.41	0.50	9	3.89	0.76	15
Insufficient details in designs	4.15	0.99	10	4.59	0.50	6	4.11	0.32	14
Lack of technical know-how to use available cost control tools	4.05	0.69	12	5.00	0.00	1	4.22	0.65	11
Late / Non involvement of QS in the project	4.55	0.69	3	4.63	0.49	4	4.56	0.51	4
Limited transferability of past experiences to new projects	3.95	0.60	14	4.70	0.47	3	4.22	0.43	12
Risk and uncertainties in the construction process	4.30	1.03	9	4.00	0.00	15	4.44	0.51	6
Type of procurement methods employed	4.15	0.59	11	4.41	0.50	11	4.78	0.43	1
Unavailability/inadequacy of cost data	3.80	0.83	15	4.22	0.58	14	4.33	0.49	10
Unstable government policies/economic conditions	4.70	0.47	2	4.56	0.64	7	4.33	0.49	7
Using out-dated cost control techniques	4.45	0.69	6	4.56	0.64	8	4.44	0.51	5
Variations in Contract	4.80	0.41	1	4.59	0.50	5	4.11	0.90	13

Researchers' Findings (2019)
Key: SD=Standard Deviation

4.4.2 Problems hindering cost control techniques/practices based on kind of work handled by respondent organizations

The different ranking of the problems hindering cost control practices by respondents based on the kind of work handled by respondents' organizations was presented in Table

4.11. Respondents working in organizations that handle only building work ranked ‘Using out dated cost control techniques’ (with a mean score of 4.89), ‘variations in contract’ (4.71) and ‘Delayed/ No payments for work done’ (4.68) as 1st, 2nd and 3rd most important problems.

Those respondents who worked in organizations that handle only civil engineering works ranked ‘Late/Non-involvement of QS in the project’, ‘unstable government policies/economic conditions’ and ‘variations in contract’ (all having mean scores of 5.00) as 1st, 2nd and 3rd most important problems. Meanwhile, respondents whose organizations handled both building and civil engineering work ranked ‘complexity of the project as 1st, followed by ‘type of procurement methods employed’ (4.60) and ‘unstable government policies/economic conditions’ (4.52).

Table 4.11 Determination of the Problems Hindering Cost Control Practices based on the Kind of works handled

Problems hindering Cost control practices	Building			Civil engineering			Building and Civil engineering		
	Mean Score	SD	Rank	Mean Score	SD	Rank	Mean Score	SD	Rank
Absence of professional cost control training	4.29	0.57	13	4.00	0.00	4	4.44	0.71	6
Complexity of the project	4.16	0.49	15	4.00	0.00	4	4.68	0.48	1
Delayed/ No payments for works done	4.68	0.66	3	4.00	0.00	4	4.48	0.51	4
Inadequate recording of site cost data daily from multiple sources	4.63	0.59	4	4.00	0.00	4	4.08	0.28	13
Instability in prices of construction materials	4.37	0.82	10	4.00	0.00	4	4.20	0.41	10
Insufficient details in designs	4.45	0.60	9	4.00	0.00	4	4.16	0.80	11
Lack of technical know-how to use available cost control tools	4.55	0.69	6	4.00	0.00	4	4.44	0.65	7
Late / Non involvement of QS in the project	4.63	0.59	5	5.00	0.00	1	4.48	0.51	4
Limited transferability of past experiences to new projects	4.50	0.60	8	4.00	0.00	4	4.12	0.53	12
Risk and uncertainties in the construction process	4.24	0.54	14	4.00	0.00	4	4.20	0.82	8
Type of procurement methods employed	4.34	0.58	11	4.00	0.00	4	4.60	0.50	2
Unavailability/inadequacy of cost data	4.32	0.47	12	4.00	0.00	4	3.84	0.85	15
Unstable government policies/economic conditions	4.53	0.51	7	5.00	0.00	1	4.52	0.65	3
Using out-dated cost control techniques	4.89	0.45	1	4.00	0.00	4	3.92	0.28	14
Variations in Contract	4.71	0.46	2	5.00	0.00	1	4.20	0.82	8

Researchers' Findings (2019)
Key: SD=Standard Deviation

4.4.3 Problems hindering cost control techniques/practices based on size of organization

The differences in the perceptions of respondents from organizations of varying sizes (based on number of workers) of the problems hindering cost control techniques/practices was presented in Table 4.12. Respondents working in organizations that employ less than 50 workers ranked 'unstable government policies/economic conditions' (with a mean score of 4.86), 'insufficient details in designs' (4.59), and 'Lack of technical know-how to use available cost control tools' (4.52) as 1st, 2nd and 3rd most important problems.

Respondents from mid-sized organizations (those that employ 50 – 250 workers) ranked 'unavailability/inadequacy of cost data' (MS = 5.00), 'Variations in Contract (4.88) and 'Inadequate recording of site cost data daily from multiple sources' (4.83) as the 1st, 2nd and 3rd most important problems, based on their own perception.

Table 4.12 Determination of the Problems Hindering Cost Control Practices based on the Number of employees

Problems hindering Cost control practices	Less than 50			50 - 250			More than 250		
	Mean Score	SD	Rank	Mean Score	SD	Rank	Mean Score	SD	Rank
Absence of professional cost control training	4.21	0.56	11	4.71	0.46	4	3.83	0.94	14
Complexity of the project	4.07	0.46	15	4.58	0.72	7	4.50	0.52	3
Delayed/ No payments for works done	4.24	0.58	10	4.50	0.51	11	4.00	1.04	11
Inadequate recording of site cost data daily from multiple sources	4.45	0.51	6	4.83	0.38	3	4.17	0.72	9
Instability in prices of construction materials	4.14	0.52	14	4.50	0.51	12	3.83	0.94	15
Insufficient details in designs	4.59	0.63	2	4.29	0.46	13	4.33	0.49	7
Lack of technical know-how to use available cost control tools	4.52	0.63	3	4.63	0.49	5	4.17	0.94	8
Late / Non involvement of QS in the project	4.24	0.58	9	4.54	0.51	10	4.50	0.52	4
Limited transferability of past experiences to new projects	4.41	0.50	7	3.75	0.68	15	4.17	0.72	10
Risk and uncertainties in the construction process	4.52	0.63	4	4.29	0.46	14	4.00	0.60	13
Type of procurement methods employed	4.14	0.52	13	4.63	0.49	6	4.33	0.49	6
Unavailability/inadequacy of cost data	4.14	0.74	12	5.00	0.00	1	4.50	0.52	1
Unstable government policies/economic conditions	4.86	0.52	1	4.54	0.51	8	4.00	0.60	12
Using out-dated cost control techniques	4.52	0.63	5	4.54	0.51	9	4.33	0.78	5
Variations in Contract	4.38	0.62	8	4.88	0.34	2	4.50	0.52	2

Researchers' Findings (2019)
Key: SD=Standard Deviation

4.5 Relationship between Implementation of Cost Control Practices and Cost Performance of Projects

This section of the chapter tackled Objective Four of this study as stated in Chapter One. Primary data was collected through self-administered questionnaires on the level of impact that the implementation of cost control on construction projects has on the cost performance of the projects; these were analysed using Spearman's Rank Correlation. The result, which covered the five practices that are associated with a cost control system for projects, was presented in Table 4.13.

Three of the five cost control practices were found to be significantly correlated with the cost performance of construction projects; these were (i) Forecasting costs, (ii) Estimating contingency and (iii) Comparing costs. In all of the three cases, the 'Sig.' value was lower than the 'alpha' threshold of significance, which was 0.05. All of the three significant correlations were however observed to be weak, in terms of strength, since not more than 27% of variations in the values of cost performance were associated with variations in the values of the three significant cost control practices. This was based on the R^2 values.

It was however interesting to note that positive linearity in the case of 'Forecasting costs' and 'Comparing costs' meant that higher implementation of these practices would be associated with higher cost performance of construction projects. Negative linearity was observed in the case of 'Estimating contingency'; this meant that deriving estimates of contingency allowances to be added to the construction cost would be associated with lower cost performance of projects. The association between 'setting up cost system' and 'variance analysis' against the cost performance of projects was non-significant, since the 'Sig.' values were higher than 0.05.

Table 4.13 Relationship between cost control practices and cost performance

Aspect of Cost control Practice	**N**	**Spearman's rho**	**R^2 (%)**	**Sig. (2-tailed)**	**Linearity**	**Strength of association**	**Remark**

Forecasting costs	**65**	**0.455**	**20.703**	**.000**	**Positive**	**Weak**	**SS**
Estimating contingency	**65**	**-0.262**	**6.864**	**.035**	**Negative**	**Weak**	**SS**
Setting up cost system	65	-.174	3.017	.166	Negative	Weak	NS
Comparing costs	**65**	**0.524**	**27.458**	**.000**	**Positive**	**Weak**	**SS**
Variance analysis	65	.141	1.975	.264	Positive	Weak	NS

Researchers' Findings (2019)
Key: NS=Non-Significant; SS=Statistically Significant

4.6 Discussion of Results

Carrying out cash-flow analysis and preparing work programmes might not be very widespread in the construction industry, since it was only ranked 9th out of 18 cost control techniques. It was instructive that 'Use of S-curve for cost/time monitoring' was considered the least applied technique. This might be in line with assertions of writers such as Otim et al. (2015) that lack of technical knowledge is a major problem of project cost control. Dindi *et al*. (2018) acknowledge the importance of experience when they recommended mentoring of younger professionals by their more experienced older counterparts; this study's finding agrees with this position. In ranking the application of cost control techniques, average scores for more experienced respondents differed sharply from those that had fewer years of working experience. This might mean that studies of cost control techniques need to target construction professionals on the basis of work experience in order to develop workable strategies.

The application of some cost control techniques such as earned value analysis (EVA), cash-flow analysis and work programmes and Work breakdown structure, from the perception of respondents, were influenced by the kind of work carried out. Other techniques' application was influenced by the size of organizations; examples include Cost reports, Use of software for cost control, and Use of S-curve for cost/time monitoring. It can be inferred from these findings that larger organizations might have more resources that allow them the use of lesser known and more complex techniques for cost control (Adejei *et a.l*, 2017). This is an advantage of scale that smaller firms, who form the bulk of firms in the construction industry, are rarely able to enjoy.

Olawale & Sun (2010) observed that the level of implementation of cost control techniques was overwhelming in UK. This study found that approximately 80% of the respondents always conducted variance analysis to determine resources for budget deviations; 57% of the sample always compared the actual costs with forecasted budget at consistent decision intervals, while 79% always provided 'estimating contingency allowance for project budget'. Given these findings against the backdrop of poor cost performance of projects, the position of Malkanthi et al. (2017) who argued that the problem is not a lack of knowledge of cost control techniques, but rather the discipline to strictly apply such techniques appears valid.

The findings of this study are in agreement with Adejei *et al*. (2017) who identified a number of problems facing the implementation of cost control techniques/practices. Some of the challenges identified were (i) Delayed/ No payments for works done; (ii) Late/Non-involvement of QS in the project; and (iii) Unstable Government Policies/ Economic Conditions; (iv) Using out-dated cost control techniques and (v) type of procurement methods. The problem that was considered least important was 'Unavailability/inadequacy of cost data'.

The length of working experience, type of work and size of firm all influence how people perceive the importance of the problems that confront the implementation of cost control techniques/practices. Respondents who have worked for more 25 years ranked 'the type of procurement methods employed' as 1st; for those in organizations that handle only building work, the most important problem was 'Using out dated cost control techniques'. Respondents that worked in organizations that employ less than 50 workers considered

‘Lack of technical know-how to use available cost control tools’ as one of the most important problems of cost control. These findings add to the conclusions of writers such as Otim et al. (2015) and Adejei *et al.* (2017) with respect to the influence of experience, size and work type on problems of cost control.

Cost control practices do not exert very great influence on cost performance of projects, given the highest R^2 values of 27% observed. This might be as a result of low strict implementation of these practices, argued by Malkanthi et al. (2017). However more efforts committed to forecasting and comparing costs would be rewarded with higher project cost performance. On the other hand, putting more efforts into the estimation of contingency allowances will likely lead to lower cost performance of projects.

4.7 Summary of Findings

The findings of this study were summarized in this section.

1) The major cost control techniques applied on construction projects have been identified as (i) controlling of sub-contracts costs, (ii) contract variance-unit costing, (iii) cost report, (iv) schedule monitoring, and (v) control of material, equipment and labour costs.
2) Variance analysis to determine reasons for budget deviations is always carried out by 80% of the respondents; only 57% of the sample always compared the actual costs with forecast budget at consistent decision intervals, while 79% of the respondents always estimated contingency allowance for project budgets.
3) The most important problems facing the implementation of cost control on construction projects were found to be (i) delayed/ no payment for works done, (ii) late/non-involvement of QS in the project, (iii) variation in contract, (iv) lack of technical know-how to use available cost control tools, and (v) type of procurement methods.

4) There was a significant relationship between three cost control practices (Forecasting costs, Estimating contingency and Comparing costs) and cost performance of projects.

CHAPTER FIVE

5.0 CONCLUSION, RECOMMENDATION AND AREAS FOR FURTHER STUDY

5.1 Conclusion

The challenges facing projects in the construction industry are daunting, of which cost-related problems are chief among them. Based on the findings of this study, it was concluded that cost control practices affect project cost performance in a significant way.

The major cost control techniques applied on construction projects have been identified as controlling of sub-contracts costs, contract variance-unit costing, cost report, schedule monitoring, control of material, equipment and labour costs. The extent of implementation of cost control practices depend upon the work experience, nature of works carried out and the staff strengths of construction organizations. The major challenges experienced during the implementation of cost control on building projects are related to challenges of payment for works done and late/non-involvement of QS in the project.

5.2 Recommendations

The following recommendations have been made, based on the findings of the study.

1. Each of the techniques and practices of cost control have their own merits and demerits. Furthermore, there are specific situations that suit the use of some techniques and practices of cost control more than others. It is thus recommended that project organizations explore the suitability of different techniques and practices in order to find the ones that best fit their activities.
2. Projects organizations must also be aware that the extent of implementation of cost control practices depend upon the work experience, nature of works carried out and the staff strengths of construction organizations. It is recommended that a Quantity

Surveyor be introduced into the project as early as possible to help address cost challenges right from the design stages through to the post construction.

3. It is also advised that a comprehensive scope of work be passed out and understood before commencement of any project, to reduce the occurrence of variation in the contract.
4. The government and construction organizations create avenues for training, seminars and researches for construction professionals to in increase their knowledge and skill set on using cost control.

5.3 Contribution of Study to Knowledge

The study in the following ways contributed to the existing body of knowledge. The study has provided more insight into the cost control practices applied and preferred in among the construction professionals in Abuja, FCT, Nigeria. This serves as an aid in understanding the diverse perceptions and preferences on cost control practices based on the age of the existence of the organizations, nature of works handled and number of employees. The study has also examined the level of implementations of cost control principles in the construction industry, in Abuja-FCT, Nigeria and provided findings on the problems hindering cost control practices, and how it differs base on the age of the firms, nature of works handled, and number of workers employed. It has also identified the influence of the cost control practices on cost performance of projects.

5.4 Areas for Further Study

1. A review of available of cost control tools employed on construction projects in Abuja-FCT.
2. The influence of construction procurement methods on control of cost of construction projects.
3. The influence of variations on control of construction cost.

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APPENDICES

APPENDIX A: Research Questionnaire

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
SCHOOL OF ENVIRONMENTAL TECHNOLOGY,
DEPARTMENT OF QUANTITY SURVEYING
MAIN CAMPUS GIDAN-KWANO, MINNA, NIGER STATE.

Department of Quantity Surveying,
School of Environmental Technology,
Federal University of Technology,
P.M.B. 65, Minna, Niger State.
3rd November, 2019

Dear Participant,

Re: Influence of Cost Control Practices on the Cost Performance of Construction Projects in Abuja-FCT, Nigeria

My name is **OGUNGBE, Olusogo Bamidele** a Masters (M.Tech) Degree student of Quantity Surveying**,** Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology Minna, Niger State. I am conducting research on *''Influence of Cost Control Practices on the Cost Performance of Construction Projects in Abuja-FCT, Nigeria''*.

Your participation in filling the attached questionnaire will be crucial to the successful conclusion of this research. Please note that all information provided will be used for academic purposes only, and no personal identity information is required. Therefore do not include your name or telephone number in your response.

If you have questions or observations at any time about the survey or procedures, please make use of the contact information below:

Thank you very much for your support.

Name:	**OGUNGBE, Olusogo Bamidele**	Dr. A. A. OKE
Position:	Researcher	Supervisor
Contact information:	MTECH/SET/2017/7504	08023737241; abdganioke@futminna.edu.ng

Research Survey

Influence of Cost Control Practices on the Cost Performance of Construction Projects in Abuja-FCT, Nigeria

By

OGUNGBE, Olusogo Bamidele

Department of Quantity Surveying, Federal University of Technology Minna, P.M B. 65, Minna, (Gidan Kwano Campus), Niger State, Nigeria.

Section A: Demographic information

Q1. Please provide information about the respondent as requested by selecting one of the options provided.

A	Profession of respondent	1	Architect	
		2	Builder	
		3	Engineer	
		4	Estate Surveyor	
		5	Quantity Surveyor	
		6	Town Planner	
		7	Other (specify)	

B	Educational attainments	1	OND/NCE	
		2	HND/B.Sc	
		3	M.Sc	
		4	Ph.D	
		5	Other (specify)	

C	Type of organisation	1	Consulting firms	
		2	Contractor	
		3	Client organization	
		4	Ministries, Department, Agencies (MDAs)	
		5	Academic institutions	
		6	Others	

D	Respondents gender	1	Female	
		2	Male	

E	Work experience of respondent	1	Less than 5 yrs	
		2	5 yrs – 15 yrs	
		3	16 yrs – 25 yrs	
		4	More than 25 yrs	

F	Type of works handled	1	Building	
		2	Civil engineering	
		3	Building and Civil engineering	

		4	Others	

G	Number of Employees	1	Less than 50	
		2	50 - 250	
		3	More than 250	

Section B: Cost control techniques applied on construction projects

Q2. Kindly use the five point scale provided to identify the extent to which the following cost control techniques are employed in your organisation:
5 (VHE) =Very High Extent; 4 (HE) = High Extent; 3 (ME) = Moderate Extent;
2 (LE) = Low Extent; 1 (VLE) = Very Low Extent.

	Statements related to the extent of use of cost control techniques	**5 VHE**	**4 HE**	**3 ME**	**2 LE**	**1 VLE**
2.1	Budget Monitoring					
2.2	Cash-flow analysis and work programmes					
2.3	Contract Variance – Unit Costing					
2.4	Controlling of Sub-contracts costs					
2.5	Controlling Overheads and Indirect Costs					
2.6	Cost estimating and budgeting					
2.7	Cost Forecasting techniques					
2.8	Cost Reports					
2.9	Cost Value Reconciliation (CVR)					
2.10	Earned value analysis (EVA)					
2.11	Control of material, equipment and labour costs					
2.12	Monte Carlo simulation of project costs					
2.13	Resources management related strategy					
2.14	Schedule Monitoring					
2.15	Use of S-curve for cost/time monitoring					
2.16	Use of software for cost control					
2.17	Variance analysis					
2.18	Work Breakdown Structure (WBS)					

Section C: Level of implementation of cost control practices

Q3. Please provide information about the frequency with which the following cost control practices are implemented in your organisation.

	How frequently are the following cost control practices implemented in your organisation?	***Always***	***Sometimes***	***Never***
		3	**2**	**1**
3.1	Forecasting costs for project budget			
3.2	Estimating contingency allowance for project budget			
3.3	Setting up cost recording system for the project			
3.4	Comparing actual costs with forecasted budget at consistent decision intervals			
3.5	Conducting variance analysis to determine reasons for budget deviations			

Q4. Please use the scale below to indicate the extent to which specific cost control practices have been applied at specific stages of the cost control system in projects. Leave blank spaces for cost control practices that do not apply.

<u>Use</u> *'5' for 'Very High Influence';*
'4' for' High Influence';
'3' for 'Moderate Influence';
'2' for 'Low Influence';
'1' for 'Very Low Influence'.

	How frequently are the following cost control techniques employed during implementation of these cost control practices in your organisation?	**Cash-flow analysis**	**Work programming**	**Cost forecasting**	**Cost reports**	**Cost Value Reconciliation**	**Earned Value Analysis**	**Monte Carlo simulation**	**Use of S-curve**	**Use of software**	**Work Breakdown Structure**
	Practices	a	B	c	d	e	f	g	h	I	j
4.1	Forecasting costs for project budget										
4.2	Estimating contingency allowance for project budget										
4.3	Setting up cost recording system for the project										
4.4	Comparing actual costs with forecasted budget at consistent decision intervals										
4.5	Conducting variance analysis to determine reasons for budget deviations										

Q5. Please provide information about the performance of the projects undertaken by your organisation in terms of cost, time and quality.

3 (HS) = Highly Satisfactory = (71% to 100%);
2 (MS) = Moderately Satisfactory = (51% to 70%);
1 (LS) = Less Satisfactory = (0% to 50%);

	What is the approximate level of performance of the projects undertaken by your organisation?	***Less Satisfactory***	***Moderately Satisfactory***	***Highly Satisfactory***
5.1	In terms of COST performance?			
5.2	In terms of TIME performance?			
5.3	In terms of QUALITY performance?			

Section D: Problems of implementing cost control on building projects

Q6. Kindly use the five point scale provided to rate the extent to which you believe each of the following factors influence the level of implementation of cost control in projects:

5 (SA) = Strongly Agree; 4 (A) = Agree; 3 (N) = Neutral; 2 (D) = Disagree; 1 (SD) = Strongly Disagree.

	Extent to which the following factors influence the level of implementation of cost control in projects	**5 SA**	**4 A**	**3 N**	**2 D**	**1 SD**
6.1	Absence of professional cost control training					
6.2	Complexity of the project					
6.3	Delayed/ No payments for works done					
6.4	Inadequate recording of site cost data daily from multiple sources					
6.5	Instability in prices of construction materials					
6.6	Insufficient details in designs					
6.7	Lack of technical know-how to use available cost control tools					
6.8	Late / Non involvement of QS in the project					
6.9	Limited transferability of past experiences to new projects					
6.10	Risk and uncertainties in the construction process					
6.11	Type of procurement methods employed					

	Extent to which the following factors influence the level of implementation of cost control in projects	5 SA	4 A	3 N	2 D	1 SD
6.12	Unavailability/inadequacy of cost data					
6.13	Unstable government policies/economic conditions					
6.14	Using out-dated cost control techniques					
6.15	Variations in Contract					

Other factors (please specify)

6.16						
6.17						
6.18						

Q7. Please use the scale below to indicate the extent to which specific barriers have influenced specific stages of the cost control system in projects. Leave blank spaces for barriers that do not apply.

<u>*Use*</u> *'5' for 'Very High Influence';*
'4' for' High Influence';
'3' for 'Moderate Influence';
'2' for 'Low Influence';
'1' for 'Very Low Influence'.

	Extent to which the following factors influence the level of implementation of cost control practices in projects	Forecasting costs	Estimating contingency	Setting up cost system	Compare actual with budget	Variance analysis
		a	b	c	d	e
7.1	Absence of professional cost control training					
7.2	Complexity of the project					
7.3	Delayed/ No payments for works done					
7.4	Inadequate recording of site cost data daily from multiple sources					
7.5	Instability in prices of construction materials					
7.6	Insufficient details in designs					

	Extent to which the following factors influence the level of implementation of cost control practices in projects	Forecasting costs	Estimating contingency	Setting up cost system	Compare actual with budget	Variance analysis
		a	b	c	d	e
7.7	Lack of technical know-how to use available cost control tools					
7.8	Late / Non involvement of QS in the project					
7.9	Limited transferability of past experiences to new projects					
7.10	Risk and uncertainties in the construction process					
7.11	Type of procurement methods employed					
7.12	Unavailability/inadequacy of cost data					
7.13	Unstable government policies/economic conditions					
7.14	Using out-dated cost control techniques					
7.15	Variations in Contract					

Thank you!

Appendix B: Statistical Analysis Printouts

Objective 1 Analyses

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Q2.1	Between Groups	13.258	2	6.629	19.298	.000
	Within Groups	21.296	62	.343		
	Total	34.554	64			
Q2.2	Between Groups	.987	2	.494	1.399	.254
	Within Groups	21.874	62	.353		
	Total	22.862	64			
Q2.3	Between Groups	13.104	2	6.552	130.575	.000
	Within Groups	3.111	62	.050		
	Total	16.215	64			
Q2.4	Between Groups	1.972	2	.986	3.345	.042
	Within Groups	18.274	62	.295		
	Total	20.246	64			
Q2.5	Between Groups	.207	2	.103	.472	.626
	Within Groups	13.578	62	.219		
	Total	13.785	64			
Q2.6	Between Groups	8.555	2	4.278	5.805	.005
	Within Groups	45.691	62	.737		
	Total	54.246	64			
Q2.7	Between Groups	5.138	2	2.569	5.944	.004
	Within Groups	26.800	62	.432		
	Total	31.938	64			
Q2.8	Between Groups	2.109	2	1.054	3.667	.031
	Within Groups	17.830	62	.288		
	Total	19.938	64			
Q2.9	Between Groups	27.042	2	13.521	16.091	.000
	Within Groups	52.096	62	.840		
	Total	79.138	64			
Q2.10	Between Groups	9.931	2	4.966	5.576	.006
	Within Groups	55.207	62	.890		
	Total	65.138	64			
Q2.11	Between Groups	11.941	2	5.971	13.093	.000
	Within Groups	28.274	62	.456		
	Total	40.215	64			
Q2.12	Between Groups	2.644	2	1.322	3.058	.054
	Within Groups	26.802	62	.432		
	Total	29.446	64			
Q2.13	Between Groups	12.203	2	6.102	17.405	.000
	Within Groups	21.735	62	.351		
	Total	33.938	64			
Q2.14	Between Groups	5.909	2	2.955	8.445	.001
	Within Groups	21.691	62	.350		
	Total	27.600	64			
Q2.15	Between Groups	24.730	2	12.365	11.790	.000
	Within Groups	65.024	62	1.049		
	Total	89.754	64			

Q2.16	Between Groups	33.343	2	16.672	14.453	.000
	Within Groups	71.519	62	1.154		
	Total	104.862	64			
Q2.17	Between Groups	1.260	2	.630	1.319	.275
	Within Groups	29.602	62	.477		
	Total	30.862	64			
Q2.18	Between Groups	2.288	2	1.144	2.868	.064
	Within Groups	24.728	62	.399		
	Total	27.015	64			

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Q2.1	Between Groups	4.659	2	2.330	4.831	.011
	Within Groups	29.895	62	.482		
	Total	34.554	64			
Q2.2	Between Groups	5.606	2	2.803	10.071	.000
	Within Groups	17.256	62	.278		
	Total	22.862	64			
Q2.3	Between Groups	.661	2	.330	1.317	.275
	Within Groups	15.555	62	.251		
	Total	16.215	64			
Q2.4	Between Groups	1.407	2	.704	2.316	.107
	Within Groups	18.839	62	.304		
	Total	20.246	64			
Q2.5	Between Groups	.172	2	.086	.392	.678
	Within Groups	13.613	62	.220		
	Total	13.785	64			
Q2.6	Between Groups	3.483	2	1.741	2.127	.128
	Within Groups	50.763	62	.819		
	Total	54.246	64			
Q2.7	Between Groups	.215	2	.108	.210	.811
	Within Groups	31.723	62	.512		
	Total	31.938	64			
Q2.8	Between Groups	.620	2	.310	.994	.376
	Within Groups	19.319	62	.312		
	Total	19.938	64			
Q2.9	Between Groups	4.700	2	2.350	1.957	.150
	Within Groups	74.439	62	1.201		
	Total	79.138	64			
Q2.10	Between Groups	18.375	2	9.188	12.181	.000
	Within Groups	46.763	62	.754		
	Total	65.138	64			
Q2.11	Between Groups	5.196	2	2.598	4.600	.014
	Within Groups	35.019	62	.565		
	Total	40.215	64			
Q2.12	Between Groups	3.946	2	1.973	4.797	.012
	Within Groups	25.500	62	.411		
	Total	29.446	64			
Q2.13	Between Groups	2.228	2	1.114	2.178	.122
	Within Groups	31.711	62	.511		

	Total	33.938	64			
Q2.14	Between Groups	1.060	2	.530	1.238	.297
	Within Groups	26.540	62	.428		
	Total	27.600	64			
Q2.15	Between Groups	2.220	2	1.110	.786	.460
	Within Groups	87.534	62	1.412		
	Total	89.754	64			
Q2.16	Between Groups	1.753	2	.877	.527	.593
	Within Groups	103.108	62	1.663		
	Total	104.862	64			
Q2.17	Between Groups	1.253	2	.627	1.312	.277
	Within Groups	29.608	62	.478		
	Total	30.862	64			
Q2.18	Between Groups	4.463	2	2.231	6.134	.004
	Within Groups	22.553	62	.364		
	Total	27.015	64			

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Q2.1	Between Groups	2.922	2	1.461	2.863	.065
	Within Groups	31.632	62	.510		
	Total	34.554	64			
Q2.2	Between Groups	2.218	2	1.109	3.330	.042
	Within Groups	20.644	62	.333		
	Total	22.862	64			
Q2.3	Between Groups	3.422	2	1.711	8.293	.001
	Within Groups	12.793	62	.206		
	Total	16.215	64			
Q2.4	Between Groups	2.005	2	1.002	3.407	.039
	Within Groups	18.241	62	.294		
	Total	20.246	64			
Q2.5	Between Groups	3.785	2	1.892	11.732	.000
	Within Groups	10.000	62	.161		
	Total	13.785	64			
Q2.6	Between Groups	23.115	2	11.558	23.018	.000
	Within Groups	31.131	62	.502		
	Total	54.246	64			
Q2.7	Between Groups	1.990	2	.995	2.060	.136
	Within Groups	29.948	62	.483		
	Total	31.938	64			
Q2.8	Between Groups	15.076	2	7.538	96.125	.000
	Within Groups	4.862	62	.078		
	Total	19.938	64			
Q2.9	Between Groups	33.328	2	16.664	22.553	.000
	Within Groups	45.810	62	.739		
	Total	79.138	64			
Q2.10	Between Groups	14.110	2	7.055	8.572	.001
	Within Groups	51.029	62	.823		
	Total	65.138	64			

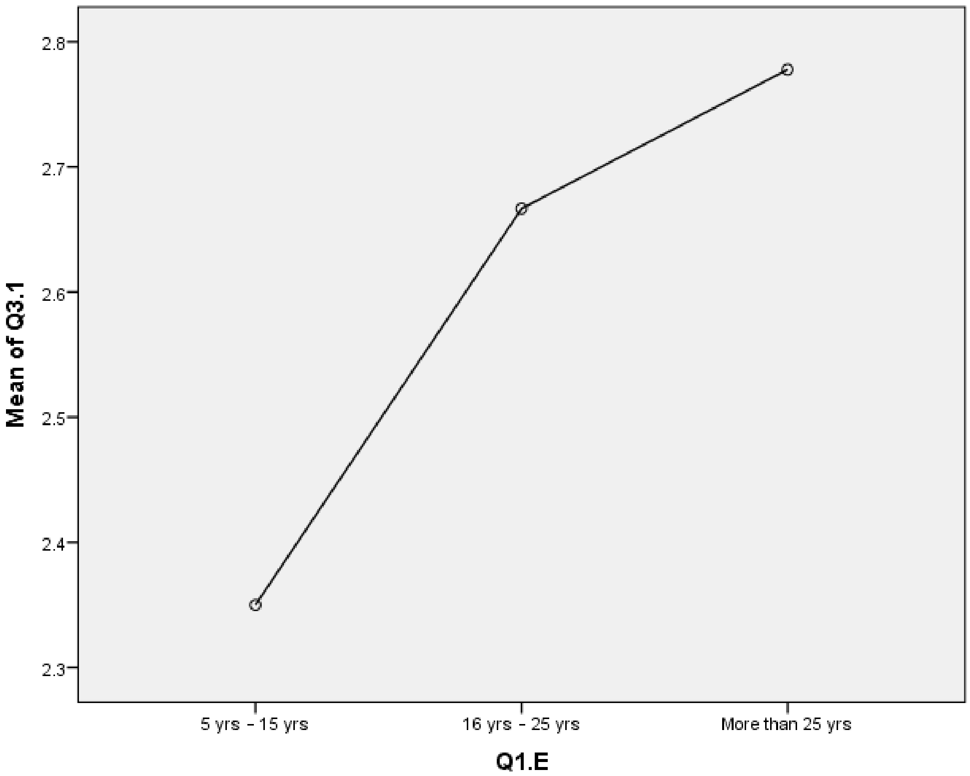
Q2.11	Between Groups	.221	2	.111	.171	.843
	Within Groups	39.994	62	.645		
	Total	40.215	64			
Q2.12	Between Groups	3.649	2	1.824	4.385	.017
	Within Groups	25.797	62	.416		
	Total	29.446	64			
Q2.13	Between Groups	3.003	2	1.502	3.009	.057
	Within Groups	30.935	62	.499		
	Total	33.938	64			
Q2.14	Between Groups	1.941	2	.970	2.344	.104
	Within Groups	25.659	62	.414		
	Total	27.600	64			
Q2.15	Between Groups	43.014	2	21.507	28.529	.000
	Within Groups	46.740	62	.754		
	Total	89.754	64			
Q2.16	Between Groups	57.896	2	28.948	38.215	.000
	Within Groups	46.966	62	.758		
	Total	104.862	64			
Q2.17	Between Groups	11.076	2	5.538	17.353	.000
	Within Groups	19.786	62	.319		
	Total	30.862	64			
Q2.18	Between Groups	3.252	2	1.626	4.243	.019
	Within Groups	23.763	62	.383		
	Total	27.015	64			

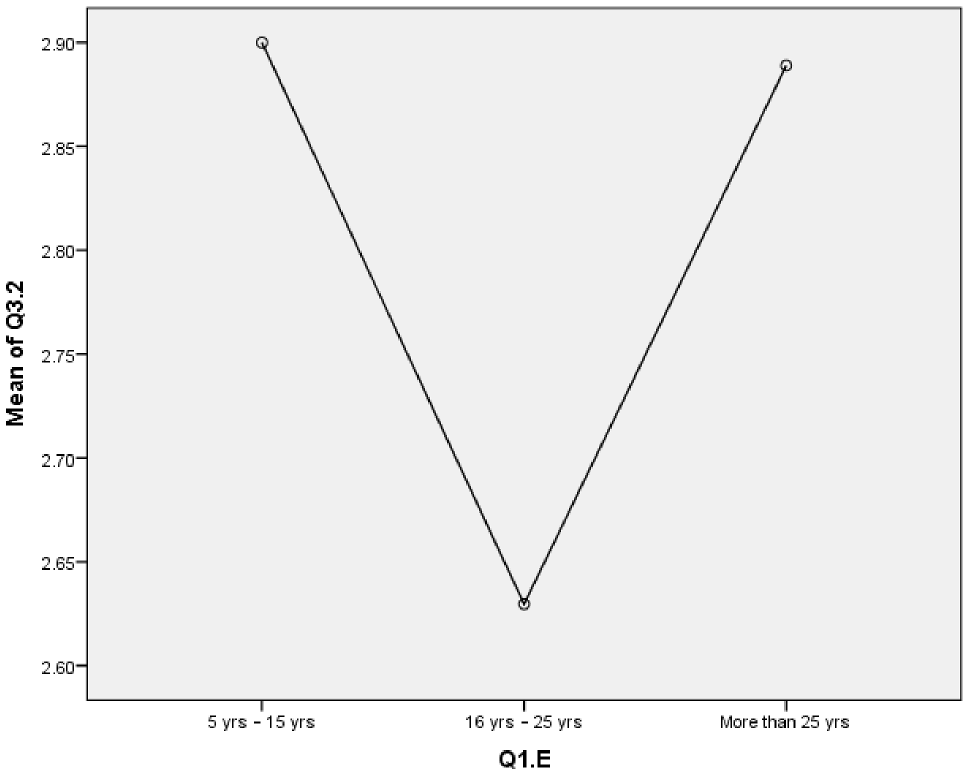
Objective 2 Analyses

ANOVA

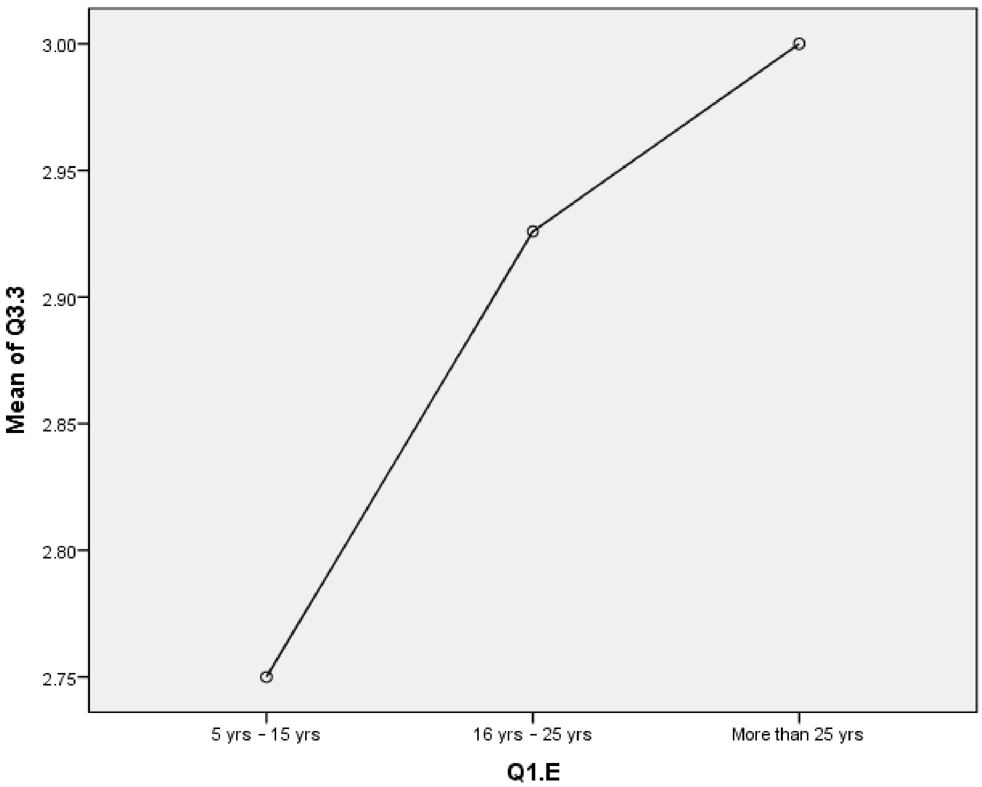
		Sum of Squares	df	Mean Square	F	Sig.
Q3.1	Between Groups	1.939	2	.969	4.400	.016
	Within Groups	13.661	62	.220		
	Total	15.600	64			
Q3.2	Between Groups	1.111	2	.555	3.487	.037
	Within Groups	9.874	62	.159		
	Total	10.985	64			
Q3.3	Between Groups	.644	2	.322	3.565	.034
	Within Groups	5.602	62	.090		
	Total	6.246	64			
Q3.4	Between Groups	1.571	2	.785	3.325	.042
	Within Groups	14.644	62	.236		
	Total	16.215	64			
Q3.5	Between Groups	.121	2	.060	.235	.791
	Within Groups	15.941	62	.257		
	Total	16.062	64			

Means Plots

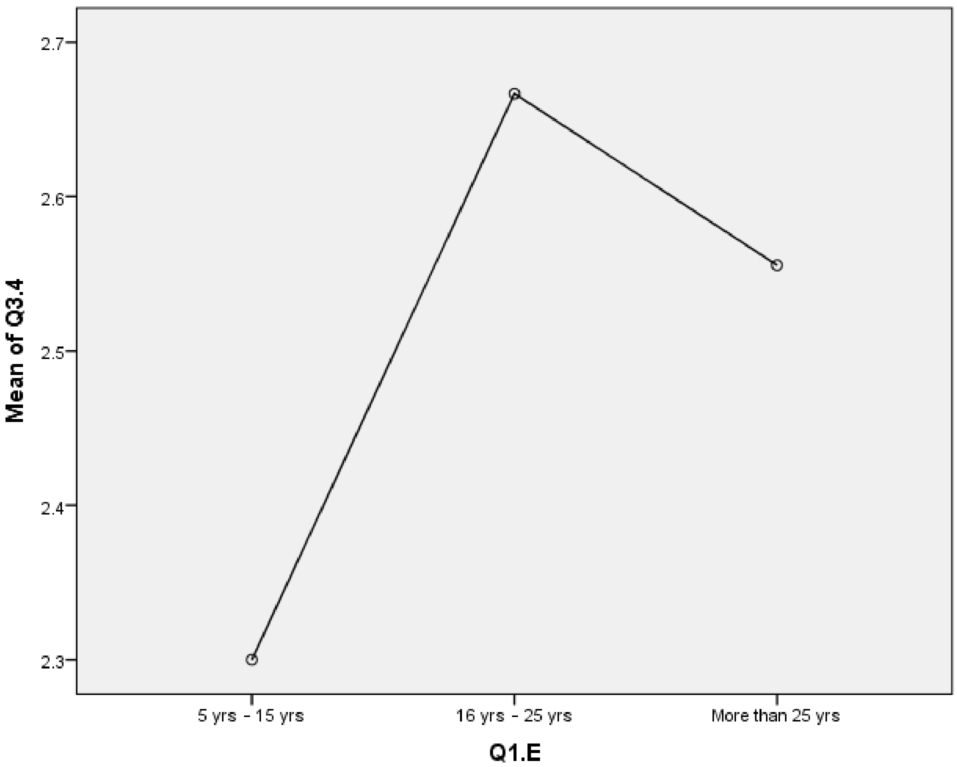


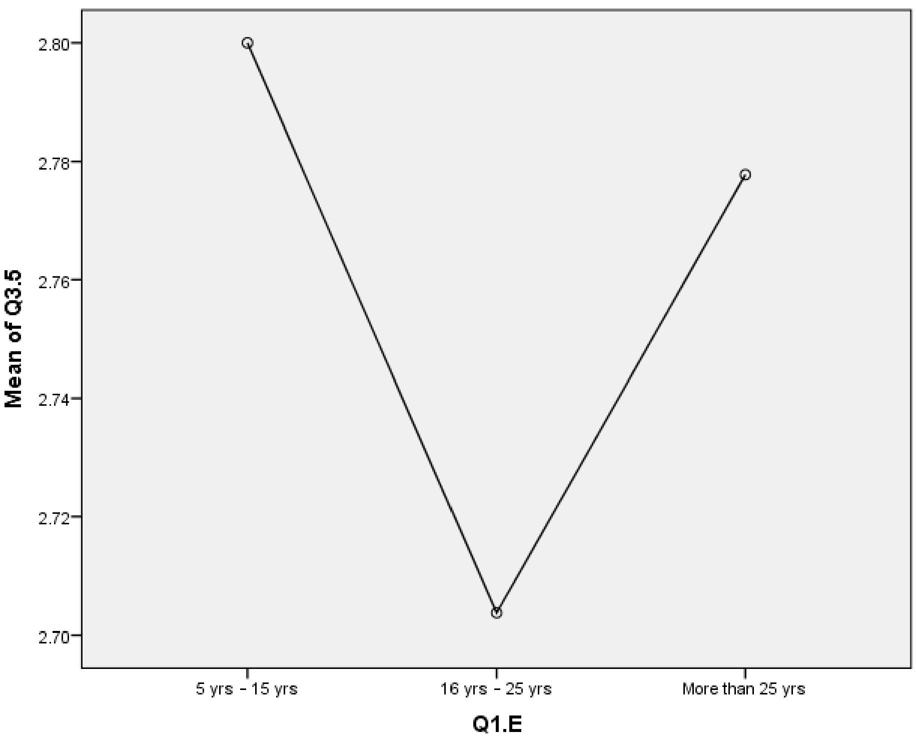


Mean of Q3.2
2.90
2.85
2.80
2.75
2.70
2.65
2.60
5 yrs - 15 yrs
16 yrs - 25 yrs
More than 25 yrs
Q1.E



Mean of Q3.3
3.00
2.95
2.90
2.85
2.80
2.75
5 yrs - 15 yrs
16 yrs - 25 yrs
More than 25 yrs
Q1.E

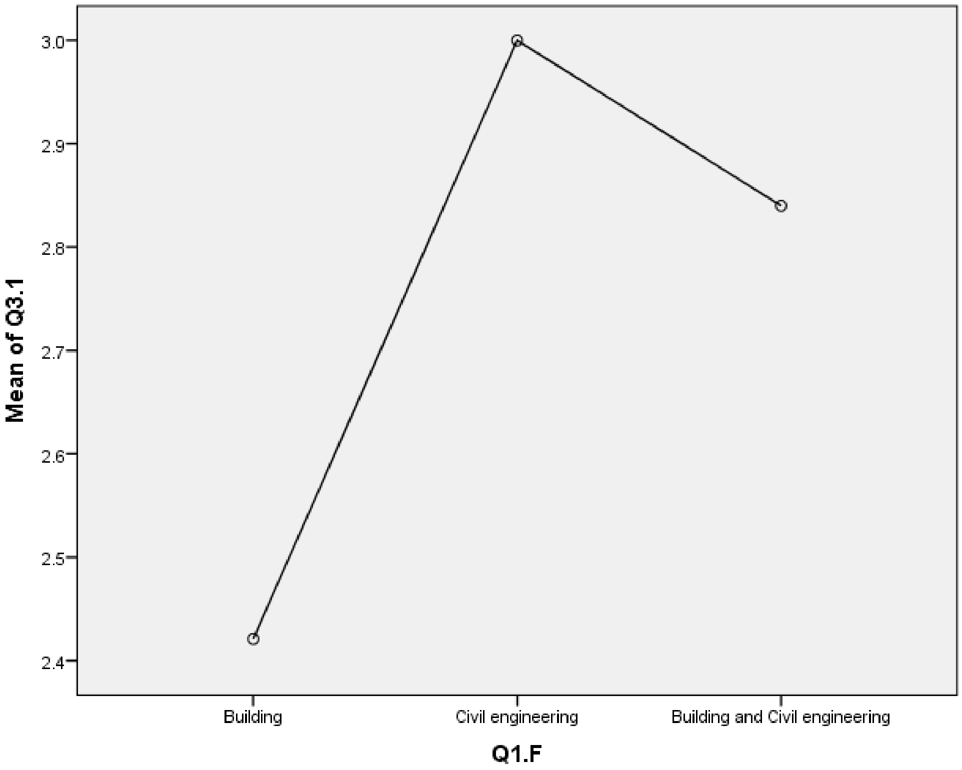

2.7
2.6
2.5
2.4
2.3
Mean of Q3.4
5 yrs - 15 yrs
16 yrs - 25 yrs
More than 25 yrs
Q1.E

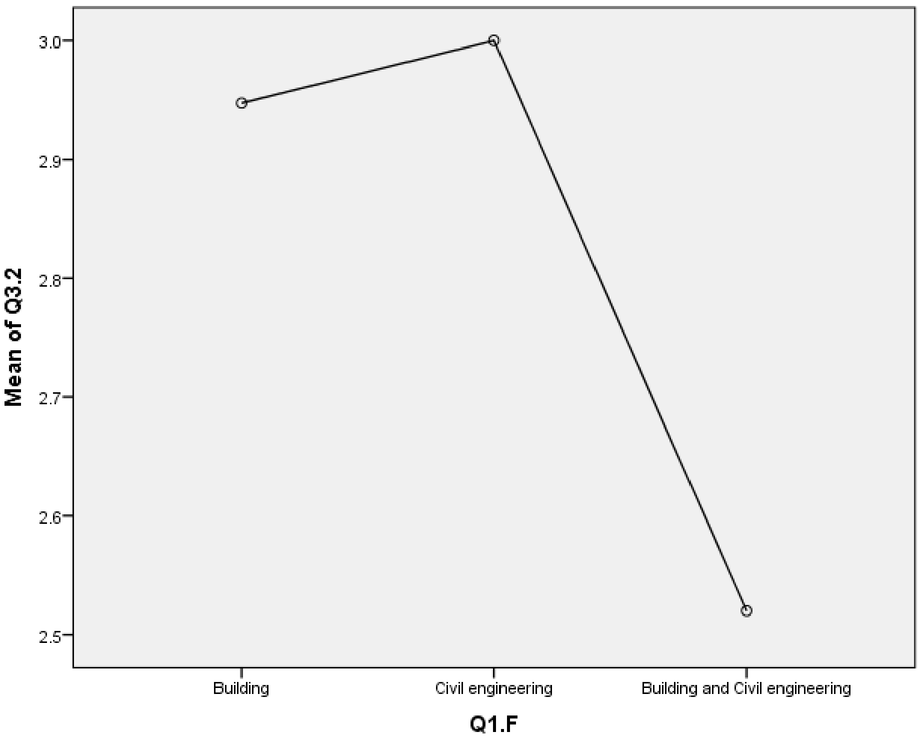

2.80
2.78
2.76
2.74
2.72
2.70
Mean of Q3.5
5 yrs - 15 yrs
16 yrs - 25 yrs
More than 25 yrs
Q1.E

ANOVA

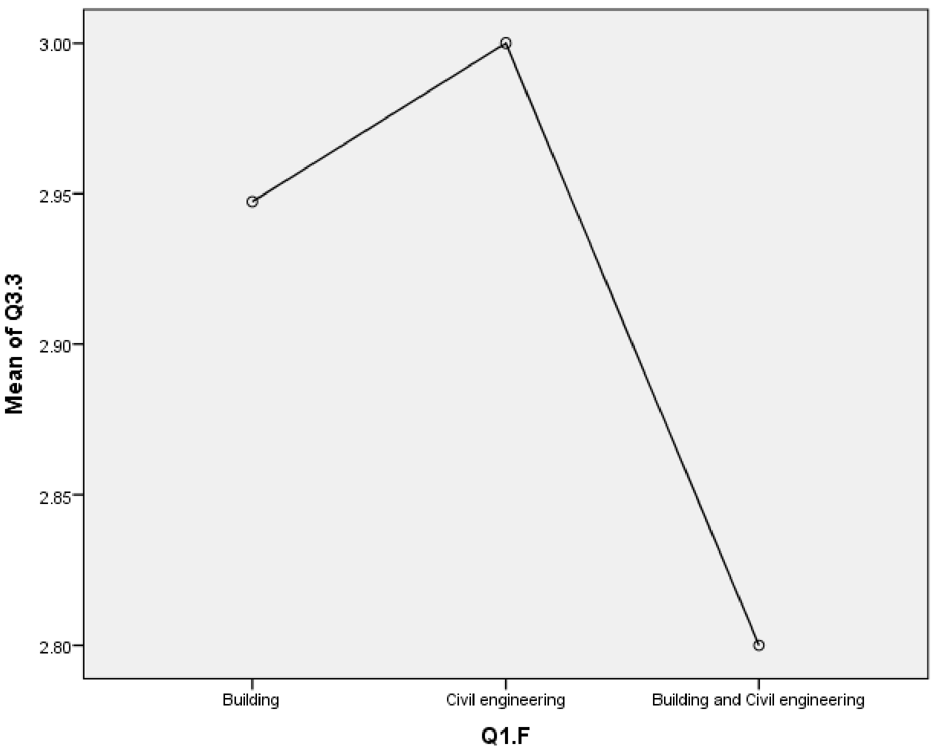
		Sum of Squares	df	Mean Square	F	Sig.
Q3.1	Between Groups	2.977	2	1.488	7.311	.001
	Within Groups	12.623	62	.204		
	Total	15.600	64			
Q3.2	Between Groups	2.850	2	1.425	10.860	.000
	Within Groups	8.135	62	.131		
	Total	10.985	64			
Q3.3	Between Groups	.351	2	.176	1.848	.166
	Within Groups	5.895	62	.095		
	Total	6.246	64			
Q3.4	Between Groups	2.333	2	1.167	5.210	.008
	Within Groups	13.882	62	.224		
	Total	16.215	64			
Q3.5	Between Groups	1.379	2	.690	2.913	.062
	Within Groups	14.682	62	.237		
	Total	16.062	64			

Means Plots

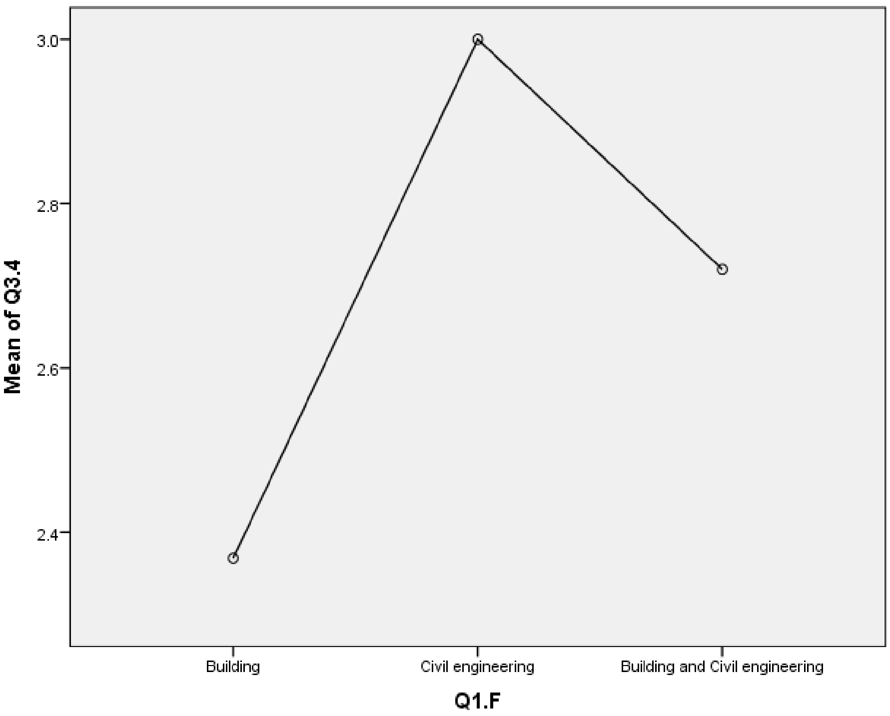


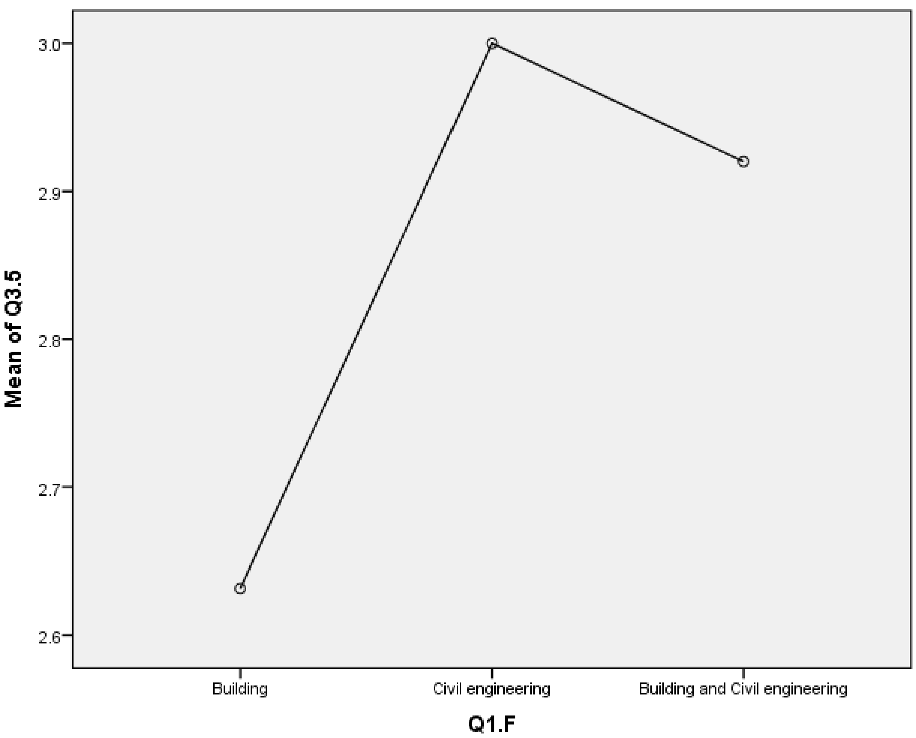


Mean of Q3.2
3.0
2.9
2.8
2.7
2.6
2.5
Building
Civil engineering
Building and Civil engineering
Q1.F



Mean of Q3.3
3.00
2.95
2.90
2.85
2.80
Building
Civil engineering
Building and Civil engineering
Q1.F

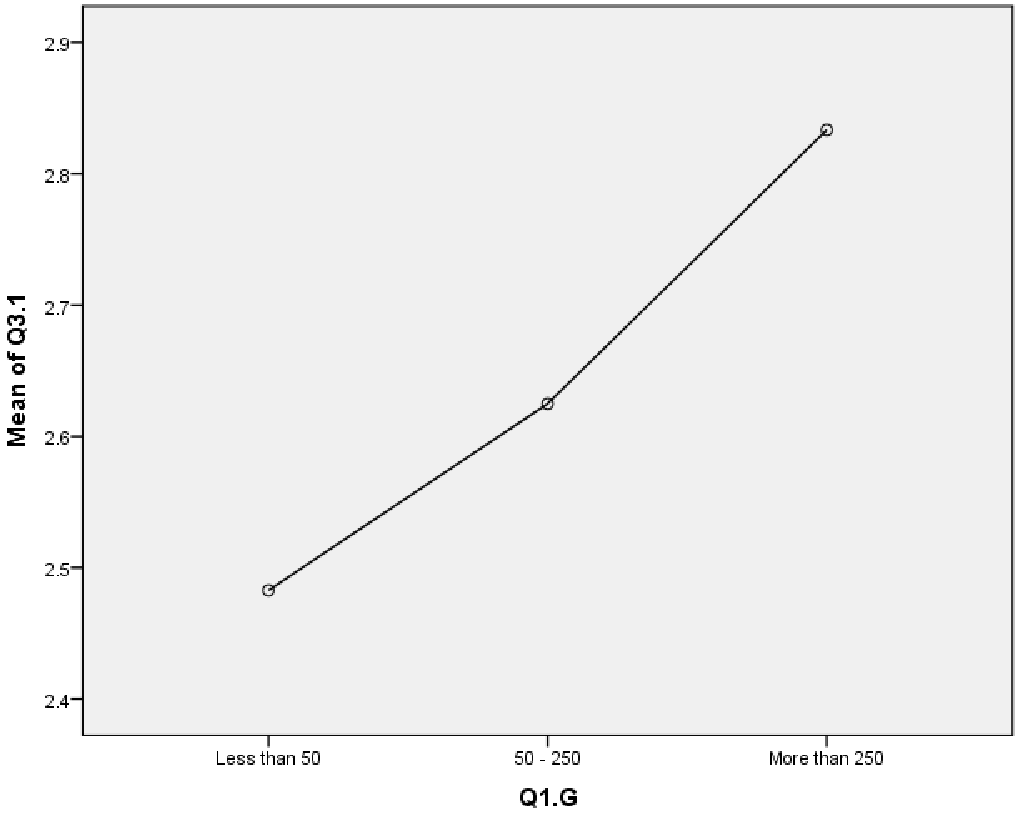

Mean of Q3.4
3.0
2.8
2.6
2.4
Building
Civil engineering
Building and Civil engineering
Q1.F

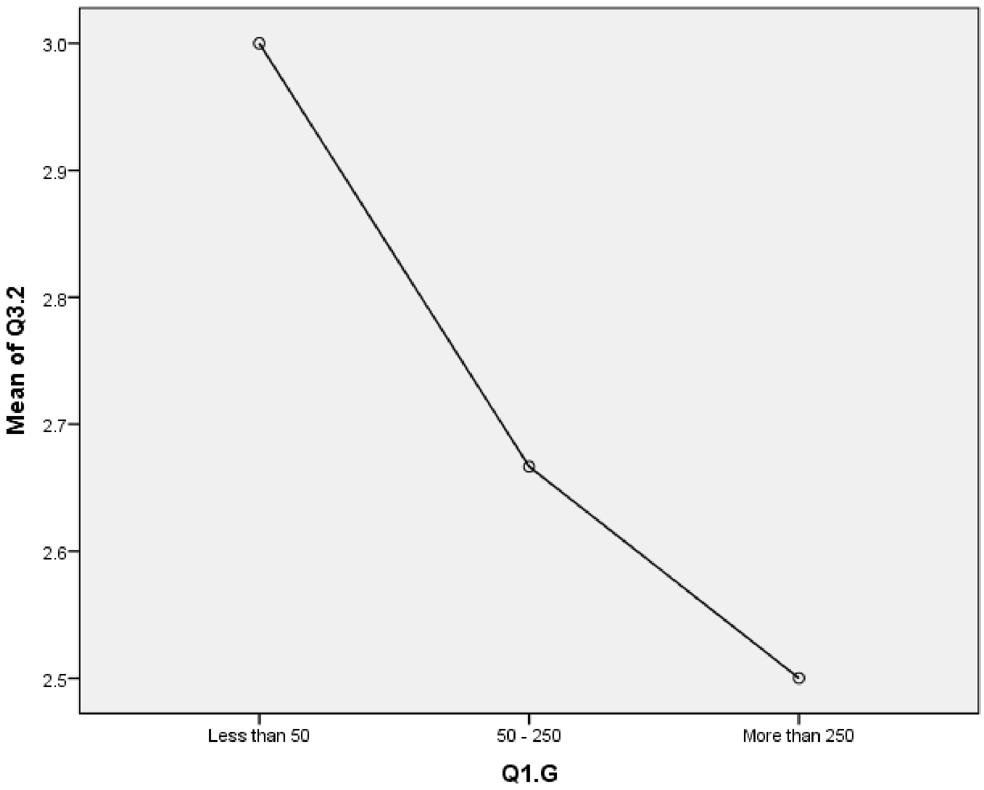

Mean of Q3.5
3.0
2.9
2.8
2.7
2.6
Building
Civil engineering
Building and Civil engineering
Q1.F

ANOVA

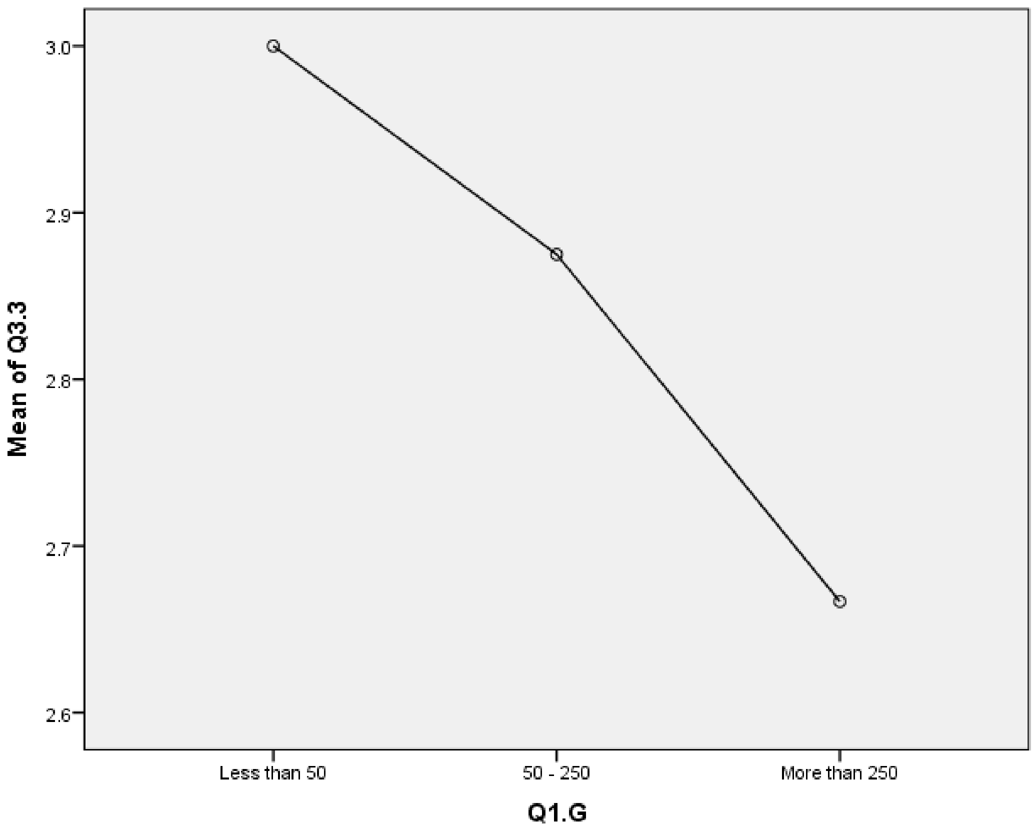
		Sum of Squares	df	Mean Square	F	Sig.
Q3.1	Between Groups	1.067	2	.533	2.276	.111
	Within Groups	14.533	62	.234		
	Total	15.600	64			
Q3.2	Between Groups	2.651	2	1.326	9.863	.000
	Within Groups	8.333	62	.134		
	Total	10.985	64			
Q3.3	Between Groups	.954	2	.477	5.592	.006
	Within Groups	5.292	62	.085		
	Total	6.246	64			
Q3.4	Between Groups	.307	2	.154	.599	.553
	Within Groups	15.908	62	.257		
	Total	16.215	64			
Q3.5	Between Groups	2.510	2	1.255	5.741	.005
	Within Groups	13.552	62	.219		
	Total	16.062	64			

Means Plots

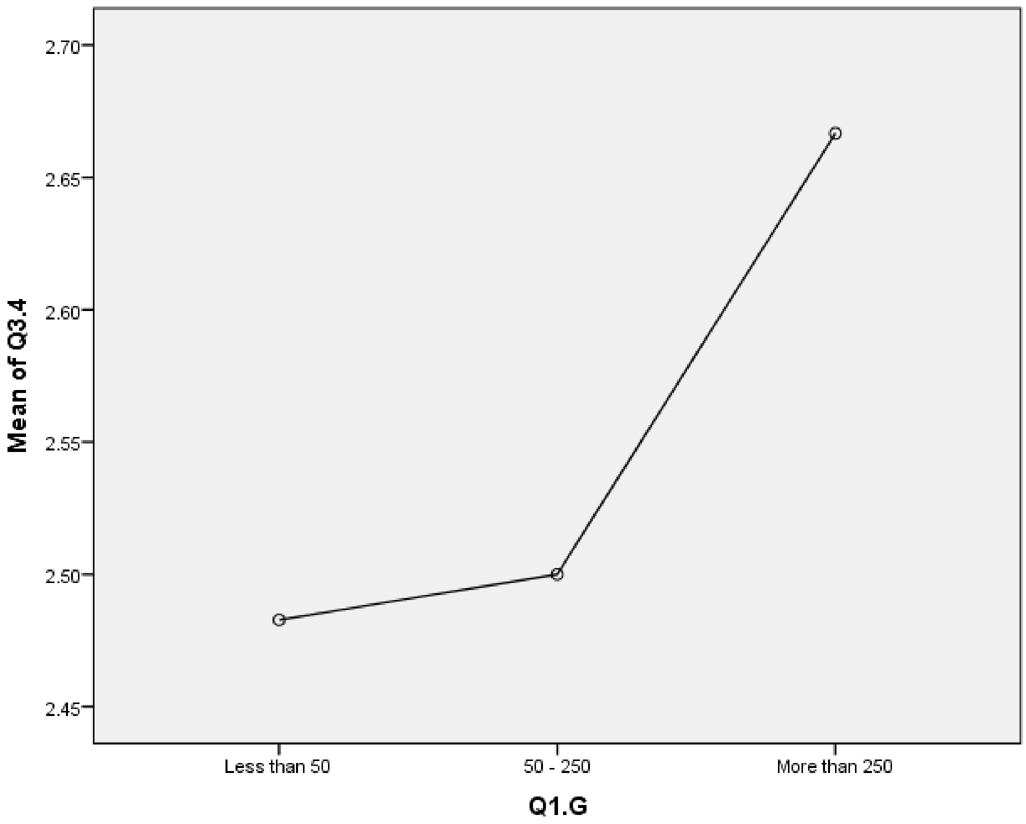


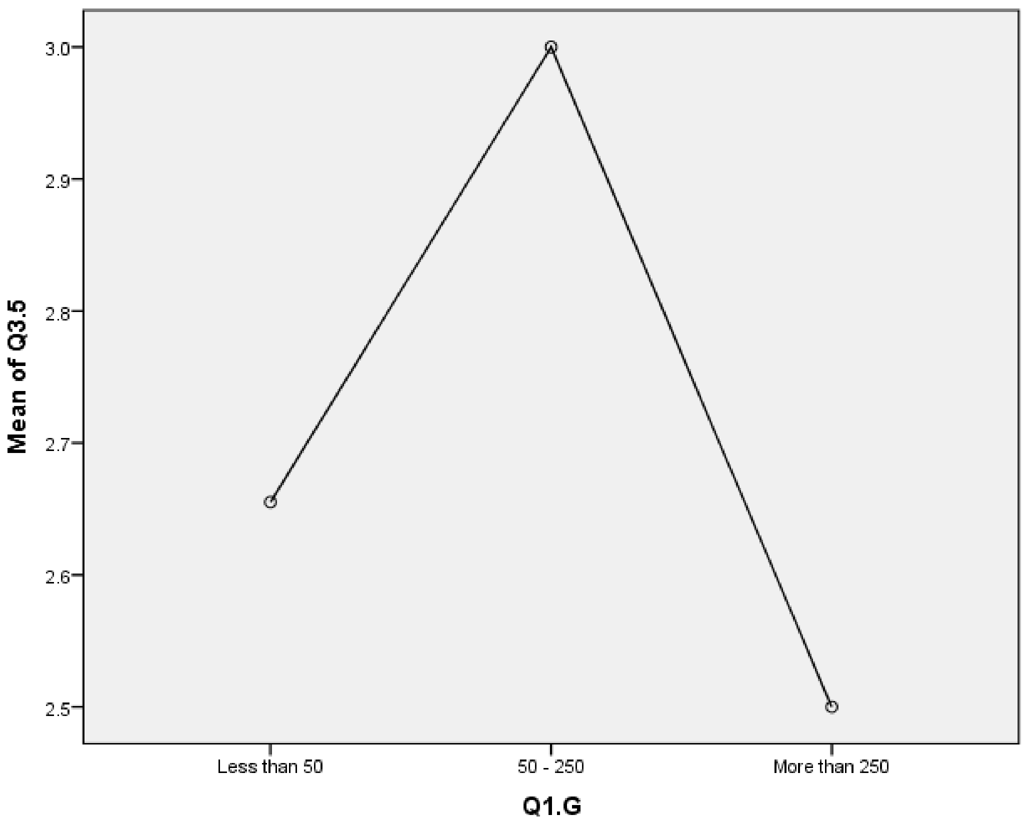


Mean of Q3.2
3.0
2.9
2.8
2.7
2.6
2.5
Less than 50
50 - 250
More than 250
Q1.G



Mean of Q3.3
3.0
2.9
2.8
2.7
2.6
Less than 50
50 - 250
More than 250
Q1.G





Objective 4 Analyses

Nonparametric Correlations

Correlations

			Q3.1_Forecasting costs	Q5.1_COST performance	Q5.2_TIME performance	Q5.3_QUALITY performance
Spearman's rho	Q3.1_Forecasting costs	Correlation Coefficient	1.000	.455**	-.175	.235
		Sig. (2-tailed)	.	.000	.163	.060
		N	65	65	65	65
	Q5.1_COST performance	Correlation Coefficient	.455**	1.000	.071	.778**
		Sig. (2-tailed)	.000	.	.572	.000
		N	65	65	65	65
	Q5.2_TIME performance	Correlation Coefficient	-.175	.071	1.000	.104
		Sig. (2-tailed)	.163	.572	.	.410
		N	65	65	65	65
	Q5.3_QUALITY performance	Correlation Coefficient	.235	.778**	.104	1.000
		Sig. (2-tailed)	.060	.000	.410	.
		N	65	65	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Q3.2_Estimating contingency	Q5.1_COST performance	Q5.2_TIME performance	Q5.3_QUALITY performance
Spearman's rho	Q3.2_Estimating contingency	Correlation Coefficient	1.000	-.262*	-.299*	-.008
		Sig. (2-tailed)	.	.035	.015	.952
		N	65	65	65	65
	Q5.1_COST performance	Correlation Coefficient	-.262*	1.000	.071	.778**
		Sig. (2-tailed)	.035	.	.572	.000
		N	65	65	65	65
	Q5.2_TIME performance	Correlation Coefficient	-.299*	.071	1.000	.104
		Sig. (2-tailed)	.015	.572	.	.410

		N	65	65	65	65
	Q5.3_QUALITY performance	Correlation Coefficient	-.008	.778**	.104	1.000
		Sig. (2-tailed)	.952	.000	.410	.
		N	65	65	65	65

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Q3.3_Setting up cost system	Q5.1_COST performance	Q5.2_TIME performance	Q5.3_QUALITY performance
Spearman's rho	Q3.3_Setting up cost system	Correlation Coefficient	1.000	-.174	.032	-.005
		Sig. (2-tailed)	.	.166	.801	.968
		N	65	65	65	65
	Q5.1_COST performance	Correlation Coefficient	-.174	1.000	.071	.778**
		Sig. (2-tailed)	.166	.	.572	.000
		N	65	65	65	65
	Q5.2_TIME performance	Correlation Coefficient	.032	.071	1.000	.104
		Sig. (2-tailed)	.801	.572	.	.410
		N	65	65	65	65
	Q5.3_QUALITY performance	Correlation Coefficient	-.005	.778**	.104	1.000
		Sig. (2-tailed)	.968	.000	.410	.
		N	65	65	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

			Q3.4_Comparing costs	Q5.1_COST performance	Q5.2_TIME performance	Q5.3_QUALITY performance
Spearman's rho	Q3.4_Comparing costs	Correlation Coefficient	1.000	.524**	-.260*	.267*
		Sig. (2-tailed)	.	.000	.037	.032
		N	65	65	65	65
	Q5.1_COST performance	Correlation Coefficient	.524**	1.000	.071	.778**
		Sig. (2-tailed)	.000	.	.572	.000
		N	65	65	65	65
	Q5.2_TIME performance	Correlation Coefficient	-.260*	.071	1.000	.104
		Sig. (2-tailed)	.037	.572	.	.410

		N	65	65	65	65
	Q5.3_QUALITY performance	Correlation Coefficient	.267*	.778**	.104	1.000
		Sig. (2-tailed)	.032	.000	.410	.
		N	65	65	65	65

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

			Q3.5_Variance analysis	Q5.1_COST performance	Q5.2_TIME performance	Q5.3_QUALITY performance
Spearman's rho	Q3.5_Variance analysis	Correlation Coefficient	1.000	.141	.746**	.177
		Sig. (2-tailed)	.	.264	.000	.159
		N	65	65	65	65
	Q5.1_COST performance	Correlation Coefficient	.141	1.000	.071	.778**
		Sig. (2-tailed)	.264	.	.572	.000
		N	65	65	65	65
	Q5.2_TIME performance	Correlation Coefficient	.746**	.071	1.000	.104
		Sig. (2-tailed)	.000	.572	.	.410
		N	65	65	65	65
	Q5.3_QUALITY performance	Correlation Coefficient	.177	.778**	.104	1.000
		Sig. (2-tailed)	.159	.000	.410	.
		N	65	65	65	65

**. Correlation is significant at the 0.01 level (2-tailed).