

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

A STUDY ON THE EFFECTS OF MANAGEMENT PRACTICES ON THE
COMPLETION TIME OF BUILDING PROJECTS

KNUST

BY

ANITA ASAMOAH-DUODU

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF BUILDING
TECHNOLOGY OF THE COLLEGE OF ARCHITECTURE AND
PLANNING, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
THE AWARD OF MASTER OF SCIENCE IN CONSTRUCTION
MANAGEMENT.

APRIL 2008

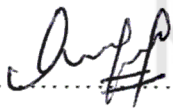
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DECLARATION

CANDIDATE'S DECLARATION

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Name.....



Date.....

29/07/09

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SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by Kwame Nkrumah University of Science and Technology.

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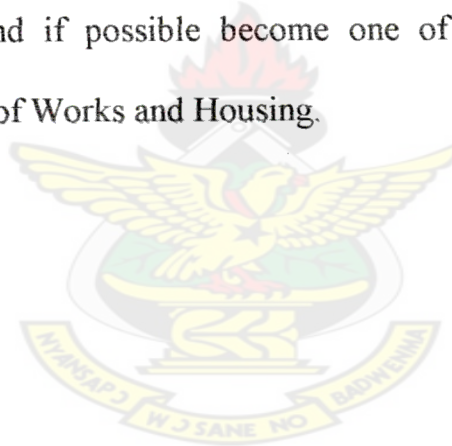
ABSTRACT

The aim of the study was to identify various management practices and how they affect the completion time of building projects in Ghana. The study involved sampling the views of major parties involved in a building project, that is client (both individual and corporate), consultants (designers and supervisors) and contractors (D1K1 classification). The study investigated the various management practices applied on a building project and determined which of the practices had strong effect on completion time. It went further to determine how significant the strongest factors were in terms of it affecting or not affecting completion time. It also determined whether consultants, clients and contractors differed in their responses as to which of the management functions (Planning, directing, organising, staffing and controlling) had the strongest effect on the completion time of building projects. The study also considered respondents application of some of the management practices on projects.

Responses from contractors, consultants and clients put together produced findings such as: identification of fifty management practices. Among these management practices, poor planning, inadequate contractor experience, long waiting time for approval of drawings by client, delay in design information and discrepancies in design, etc. were identified as some of the strongest management practices affecting delay. Again, among the strongest factors that were identified, poor site management and supervision was the most significant factor at the 95th percentile with respect to it affecting or not affecting completion time. Another finding was that clients, contractors and consultants differed in the management functions they perceived as having the strongest effect on time.

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The study concluded that management practices indeed had a strong effect on completion time of building projects. A key recommendation made from the study is the need for people in the industry to be more knowledgeable in management practices (especially the usage of various planning techniques) and if possible become one of the key qualifications for classification under the Ministry of Works and Housing.



ACKNOWLEDGEMENT

The study was made possible through the support and encouragement of many too numerous to mention. I am grateful to my supervisor, Dr. Kwame Danso for his advice, guidance and encouragement that went considerably beyond my expectation.

I am also grateful to the lecturers of the Department of Building Technology for their general contribution which made my studies very enjoyable. Another big gratitude goes to Mr. S.K. Appiah from the Department of Mathematics and Miss Veronica Kutteng of the Ministry of Education for their immense help in the statistical aspect of this study.

I am also indebted to my friends, Richard, Sylvester and Zelda and other family members who supported me and offered encouragement in the cause of my studies. Finally, I wish to say a big thank you to my parents, Mr. and Mrs Asamoah Duodu and siblings for their joint financial and emotional support.

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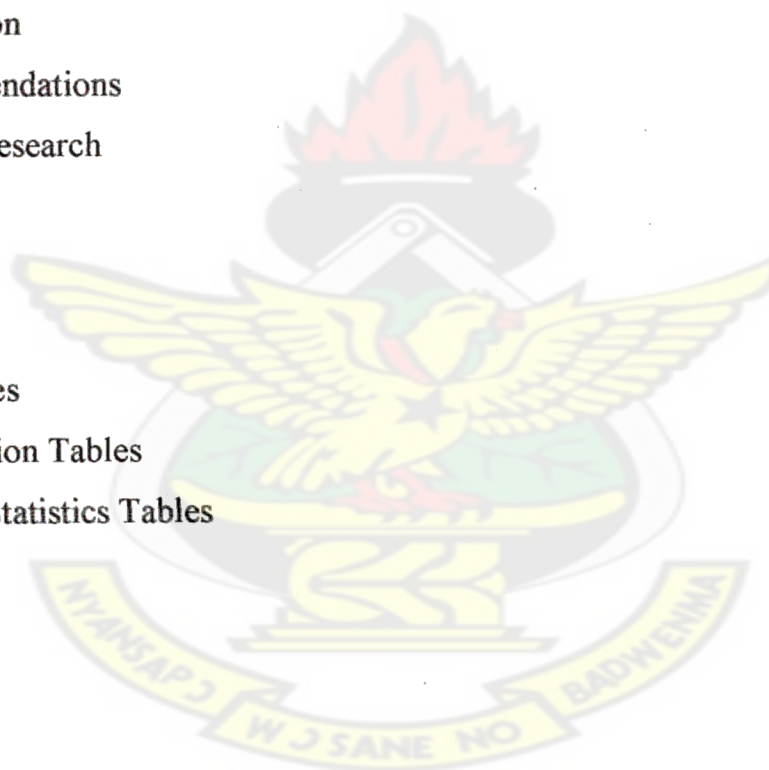
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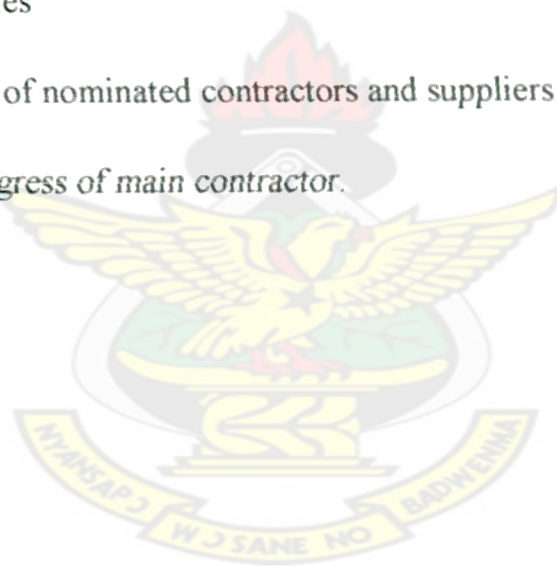
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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF STUDY

Management may be defined in so many ways, but the concept that runs through all the definitions is that, it is a process of achieving goals through the coordinated performance of specific functions of planning, organising, staffing, directing and controlling. This is a generic concept, thus it has different facets including construction management. Achieving the goal of a timely completion and successful execution of a building project involves the application of management functions and practices by the various parties on a building project namely client, consultant and contractor. Management therefore is essential in the construction industry. The recent evolvement of the project management procurement arrangement into the construction industry is an evidence of the importance of management on a building project.

However, a project is said to be successful if it is completed on time, within budget, without accident, to a specific quality standard and overall client satisfaction (Oppong, 2003). Chan (1998) also established that construction time performance is regarded as one of the critical project success factors and also gives an indication of an efficient industry. These assertions indicate that timely completion of a project is essential and can

be best achieved with management. This research seeks to consider the management practices carried out on a building project and their effect on the completion time.

1.2 STATEMENT OF PROBLEM

Over the years, a lot of research work has been carried out to investigate the causes of delays of building projects. The findings of these research works identified the causes of delays to be due to the activities carried out by the parties involved in a building project from conception to completion. Many of the activities were found to be management based. Oppong (2003) for instance identified the following factors as being responsible for the problem: poor site management and supervision, mistakes and discrepancies in design documents, flow of information between project team members, delays in design information, differences in planning and scheduling at pretender stage and long waiting time for approval of test samples of materials as some of the major causes of construction delays. Chan and Kumaraswamy (1998) also identified the following factors as being responsible for the problem: low speed of decision making involving all project teams, client initiated variations, necessary variations of works and inadequate contractor experience. Mezher and Tawai (1998) added changes in design and availability of drawings. Elinwa and Joshua (2001) identified improper planning and underestimating of project duration. Nahapiet and Nahapiet (1985) also added client experience and decisiveness and good working relation between main parties with Nick G. et al (2004) identifying client indecisiveness and non-uniformity. Ahmad et al, (2006) discovered the

disruptions in communication of information and poor timely communication of information. Okpala & Aniekwu (1988) postulated that ineffective management of site operations can be due to lack of experience level, inadequate technical and managerial manpower as well as low level of production. The above mentioned causes of delays which are management oriented strengthen the assertion that management practices have effect on the completion time of building projects.

Having deduced that management practices affect completion time of building projects, there is the need to investigate the effect of these management practices on completion time and identify the ones that have the strongest effect on completion time of building projects. By so doing, steps could be taken to ameliorate, if not eliminate, their effects on project completion times.

1.3 AIM

The aim of this research is to identify various management practices and how they affect the completion time of building projects.

1.4 OBJECTIVES

To achieve the aim of the study, the following objectives have been set:

- ♦ To identify management practices applied to a building project that affect completion time

- ♦ Determine strongest management practices that affect completion time.
- ♦ Determine whether clients, consultants and contractors differ in how they perceive the management practices that have effect on completion time.

1.5 HYPOTHESIS

- ♦ Planning is the key management function that influences project completion time the most.
- ♦ Clients, consultants and contractors differ in what they perceive as the strongest management functions that influence project completion time the most.

1.6 RESEARCH METHODOLOGY

In order to achieve the objectives outlined the study will follow the methodology outlined below:

- ♦ A comprehensive literature review from publications was carried out to identify the management practices used by the project team to attain prompt project delivery time.

- ♦ A survey was conducted in which questionnaires were distributed to sampled consultants, clients and contractors to solicit information on the extent to which each management practice influenced completion time and to identify the importance respondents attached to management issues relating to time.
- ♦ The data collected was analysed by using the Statistical Package for Social Sciences (SPSS 11) and Microsoft Excel (excel 2007) with the types of statistical test available. The Relative Importance Index (RII) was also used to identify the strongest management practices that most influence completion time. The analysis was able to determine the practices that had strong significance on the existence of project non-completion.

1.7 SIGNIFICANCE OF THE STUDY

The significance of the study is two fold.

- ♦ Firstly the study proved valuable in providing a better understanding of the issue of project non-completion, thereby complimenting the reviewed literature on effective time management of building projects.
- ♦ Secondly, the study has made some useful recommendations on improvement of time management practices which if adopted could avoid delays in future building projects Ghana.

1.8 LIMITATION

- ♦ The scope of the study is limited to DI/KI contractors located in Ghana
- ♦ The assignment of management practices to functions were subjective

1.9 ORGANIZATION OF THE STUDY

The study was grouped into five chapters.

The first chapter focused on the introduction of the study, the statement of problem and significance of the study.

The second chapter looked at the literature review.

Chapter three dealt with the method used for the study.

Chapter four discussed the analysis of the results of the study.

The fifth chapter dealt with the conclusions and recommendations of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 DEFINITION AND GENERAL INTRODUCTION TO MANAGEMENT

The word management has so many definitions but the concept that runs through all the various definitions is that, management is the process of achieving an organisation's goals through the coordinated performance of five specific functions- planning, organising, staffing, directing and controlling (Schwartz 1980; Turkson 1997; Mullins 2002; Kerzner 2003). Management is a generic concept. Thus it has many different facets like construction management, business management, hotel management, transport management, hospital management and so on but the concept is the same for all the facets. The focus of this study is on construction management.

Construction management is a management process in which a group of people of different skills and background work together to execute a construction project economically without affecting the quality in a well planned and organised manner. Management is essential in construction because the limited resources need to be utilised within constraint of time under conditions of uncertainty so as to derive maximum construction output. Other reason that makes management an essential component of the construction industry is the need to complete the works in the shortest possible time and the coordination of the efforts of the project participants to achieve this objective. Proper understanding of construction management should

therefore, begin with the understanding of the core concept of management which is the same in all the facets of management and involves the main functions of management. The nature of the construction industry is such that the works are carried out in project form. The construction projects are temporary in nature and a one time undertaking. This characteristic of construction projects make it impossible for feedback on a project to be used on the same project. Other characteristics of building projects are that, they have specific objectives that need to be accomplished such as time, cost and scope which usually include quality. That is to say, construction projects have start and end dates and fixed budgets. Due to these special features of const projects, it is therefore not surprising then that executives and academics in the construction industry are now adapting the concept of project management for effective execution of construction projects. The concept of project management involves: 1. planning projects which includes; defining of work requirements, quality and quantity of work and defining of resources needed, and 2. Project monitoring; which also include tracking progress, comparing actual outcome to predicted outcome and analysing impacts and making adjustments if necessary. The major constraints in the execution projects are traditionally listed as scope, time and cost. These constraints are further discussed below.

2.1.1 The Traditional Triple Constraints

Traditionally, three constraints namely: scope, time, and cost are also referred to as the project management triangle where each side represents a constraint. One side of the triangle cannot be changed without impacting the others. A further refinement of

the constraints separates product 'quality' or 'performance' from scope, and turns quality into a fourth constraint. The time constraint refers to the amount of time available to complete a project. The cost constraint refers to the budgeted amount available for the project. The scope constraint refers to what must be done to produce the project's end result. These three constraints are often competing constraints: increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope. The constraints are further enlightened as follows:

- Time - Broken down for analytical purposes into the time required to complete the components of the project, which is then further broken down into the time required to complete each task contributing to the completion of each component.
- Cost - Cost to develop a project depends on several variables including (chiefly): labour rates, material rates, risk management, plant, equipment and profit. For instance, when hiring an independent consultant for a project, cost will typically be determined by the consultant's hourly or daily rate multiplied by an estimated time for completion of an assignment.
- Scope - Requirements specified for the end result. The overall definition of what the project is supposed to accomplish, and a specific description of what the end result should be or accomplished. A major component of scope is the quality of the final product. The amount of time put into individual tasks determines the overall quality of the project. Some tasks may require a given

amount of time to complete adequately, but given more time could be completed exceptionally. Over the course of a large project, quality can have a significant impact on time and cost or vice versa (Wikipedia Encyclopedia, 2006)

The first challenge in managing building projects is ensuring that a project is delivered within the defined constraints. The second, more ambitious, challenge is the optimized allocation and integration of the inputs needed to meet those pre-defined objectives. The project, therefore, is a carefully selected set of activities chosen to use resources (time, money, people, materials, energy, space, provisions, communication, quality, risk, etc.) to meet the pre-defined objectives. The management of building construction projects requires knowledge of principles of management as well as an understanding of the design and construction process. Effective management is therefore needed to achieve a desired specific objective and constraint such as the required time frame for completion which is the major concern of this study.

A significant number of research works have emphasized more on time as an indicator of project success. Both Nkado (1995) and Chan and Kumaraswamy (1997) concluded that completing projects on time serves as an indicator of an efficient industry. Latham (1994) also reported that ensuring timely completion of projects is one of the important needs of clients in the building industry. All these examples indicate that time management of building projects are essential and at This juncture, having identified the main focus of the study as the management of time in building projects, it is essential to discuss some examples of delays caused by poor

management practices. A study by Frimpong et al. (2003) on groundwater projects in Ghana indicated that 33 out of 47 projects were delayed and among the most significant delay factors were finance related and poor contract management. Chan and Kumaraswamy (1998) also indicated six significant factors of delays all which happen to be management issues, these are; poor site management and supervision, low speed of decision making involving all project teams, client initiated variations, necessary variations of works and inadequate contractor experience. Mezher and Tawai (1998) also identified cash problems and changes in design and availability of drawings. Several works by researchers such as Almomani (2000) also identified other delay factors such as poor designs, site and economic conditions. Finally Elinwa and Joshua (2001) identified in (Nigeria) other factors such as improper planning and underestimating of project duration.

Analyses of the foregoing research works indicate that, delay factors are mostly management issues. Although other research works have shown finance as a major factor of delay in most building projects (Oppong, 2003; Mensah, 2002) asserted that the problem of financing could be minimised if the client managed his/her affairs adequately to pay contractors on time and contractors also adopt a good cost control mechanism which is an aspect of management which enhances financing during production. So, in summary, it can be said that almost all the causes of delays can be attributed to management issues and therefore, with effective application of management principles and practices, delays can be minimised. This point was supported by Nahapiet and Nahapiet (1985) who found out that out of the four main factors contributing to fast delivery of projects, two of them were management

practices; client experience and decisiveness and good working relationship between main parties.

What, therefore, are management functions especially those related to the timely completion of building projects? In the execution of building projects, management functions are practised by the various parties involved in the project. Each of these functions is also practised by the parties involved depending on the procurement system/phase in use and the stage or phase of the project. It is, therefore, essential that the roles of each of these parties are discussed before the various management functions are described.

2.2 PARTIES FORMING A BUILDING PROJECT TEAM

The following are the parties that form a building team.

2.2.1 Client

The client, otherwise known particularly in contract documents as the building owner; the employer can be public sector or private sector. A private sector client can either be an individual (examples are individuals and sole proprietors) or corporate (examples are companies and firms controlled other than by a sole principal). The public sector client is a publicly owned organisation. To the building project team, it is the client who initializes a project and it usually starts with a want or need which is termed as an input and considered by a project management team. This need is encapsulated into a brief which sets out the constraints of time, cost, quality and

safety. The satisfied need is also described as the output in project management (Maylor, 2003; Obeng-Ayirebi K. 2002).

Depending on the type of procurement system in use, the role the client plays varies but according to Moxley 1993, the common roles in all the procurement systems are: the authority to approve expenditure on projects, the form that the project takes, the timing and payment of fees.

2.2.2 Consultant

According to a viewpoint shared by Albert P.C. et al (1999), the consultant is the body appointed by the client to take up the project management role on his/her behalf. The consultant may be made up of one firm (consortium) or a group of firms with a lead consultant usually the project manager or the architect. The lead consultant coordinates the activities of all the parties. The consultant maintains tight control over time, cost and quality for the building project. The consultant also arranges meetings to facilitate the design, construction and commissioning stages of the project. The consultant referred to above comprises construction professionals (i.e. architect, quantity surveyors and engineers).

2.2.3 Contractor

A broad over simplification of the contractor's role in a building project is transforming plans and specification into a reality (Bruzan, 1998). Contractors represent the interests of clients as those interests relate to products and construction methods. Their performances are normally defined in terms of cost, time and quality.

The team includes; sub-contractors, suppliers of materials and public sector agencies.

Having identified that management functions also relate to procurement systems, the next focus is a brief discussion of the major procurement systems practised in Ghana.

2.3 PROCUREMENT SYSTEMS

Generally procurement system may be classified in respect of the level of integration of design and construction processes such as: Conventional/traditional, integrated and management-oriented procurement system. There are sub-categories under these three broad ones and they listed as follows:

1. Conventional/Traditional
2. Integrated -
 - i. Design and Build
 - ii. The variance of (i) are: Package Deal and Turnkey
3. Management Oriented -
 - i. Management contracting
 - ii. Construction management
 - iii. Project management (not a system but arrangement)

Among the various procurement systems, the traditional and management orientated are dominantly practiced in Ghana. Regarding the management oriented ones; the most common one is the project management arrangement which usually incorporates either the management contracting or the construction management (Obeng-Ayirebi K, 2002; Osei Tutu E. 1999). Discussion will further be limited to these two procurement systems.

2.3.1 Traditional

The key feature of this form of procurement is the separation of design and construction. The client appoints a team of consultants, frequently led by the architect, to design the building and prepare tender documentation from a brief given by the client. The method is characterised as a sequential approach: conception, development and implementation phases. The design team is an independent advisor to the client and the contractor is only responsible for the execution of the works in accordance with the contract documents (Ashworth and Hogg, 2001; Osei Tutu E, 1999). The figure below shows a structure showing the relationship between parties.

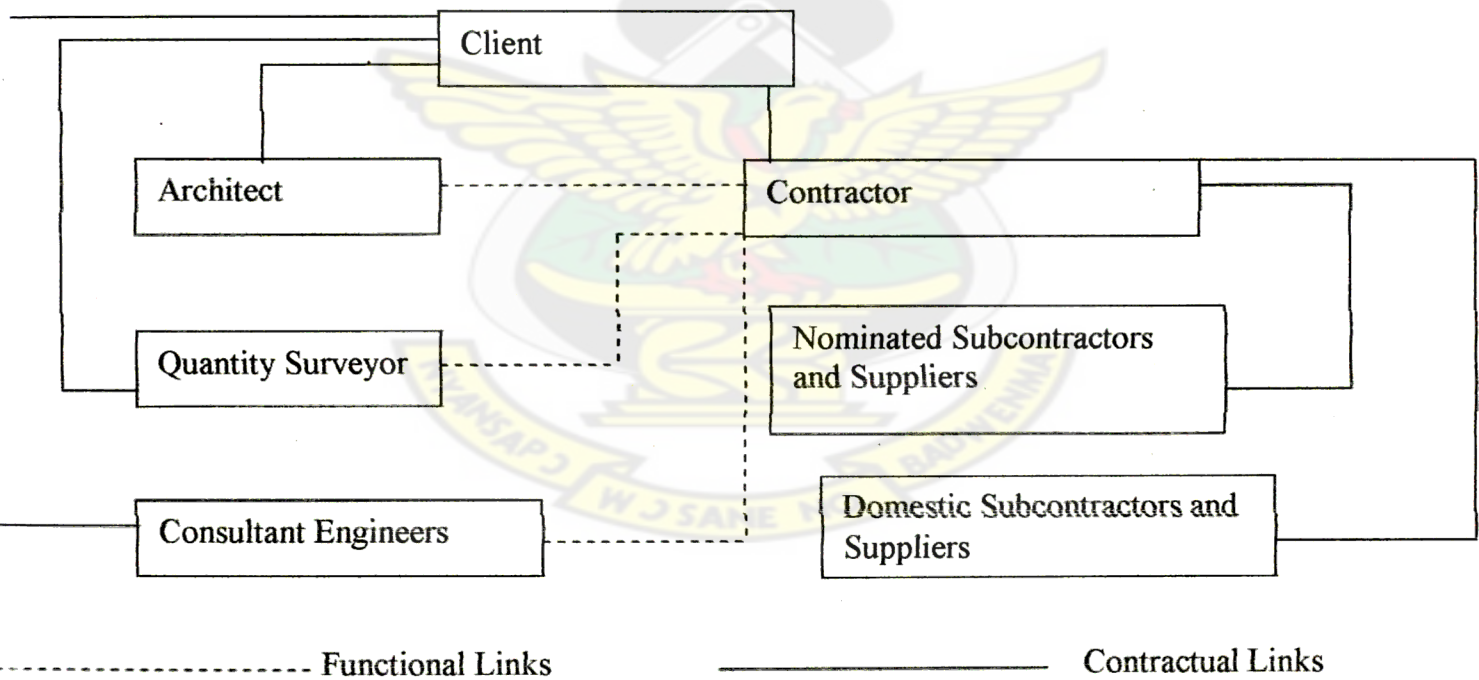


Fig. 2.1 Structure of Traditional Procurement System

2.3.2 Project Management Arrangement

The consultant (professional leader) is appointed at the inception stage of the project on a fee basis to manage and deliver the whole project. This involves a manager (normally called the project manager) who comes in right at the top interposed between client and all consultants. The arrangement is defined as the overall planning, control and coordination of a project from inception to completion on time, within cost and to required quality standards. The project manager, in effect becomes the client's representative with authority to supervise and control the entire planning and building operations from acquisition of site to completion of the project and settlement of accounts. All construction works are carried out by sub-contractors selected and appointed by a management contractor in consultation with the client and his/her professional advisors (Ashworth and Hogg, 2001). Figure 2.2 shows a typical structure showing the relationship between the parties as designed by Obeng-Ayirebi K. (2002) for the Ghanaian industry.

Another feature related to management functions is briefly discussed below.

2.4 PROJECT PHASES

The two main phases of a building project are pre and post contract phases.

2.4.1 Pre-Contract Phase

This is the first phase of the project. It begins from the period where the client makes a decision to put up a building, through the tendering stage to when the contract is signed with the contractor to put up the building.

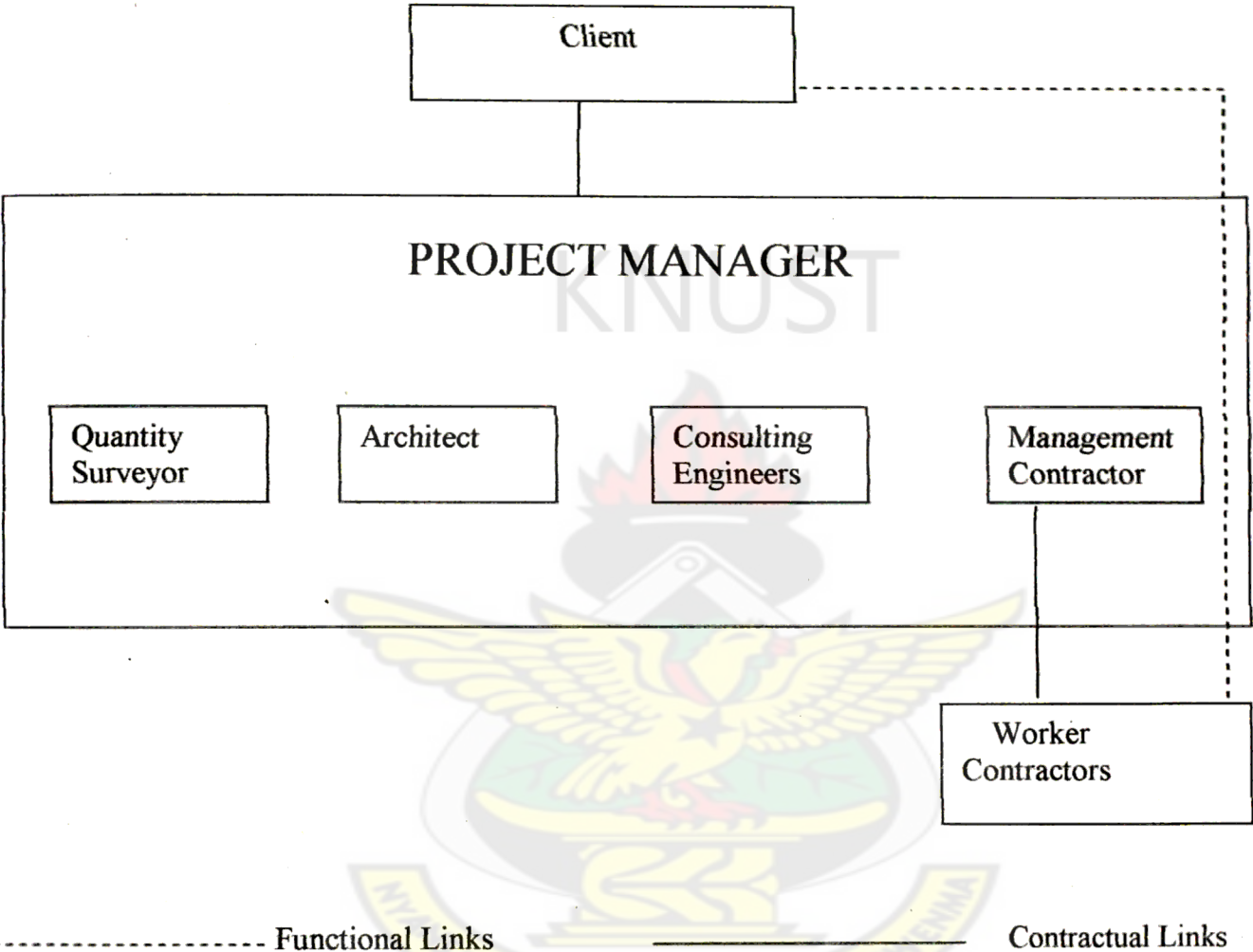


Fig 2.2 Structure of the Management Contracting System

2.4.2 Post-Contract Phase

This phase starts from where the contractor has signed the contract for execution of the works, through the construction stage, defects liability period to when the contractor is paid after the final certificate.

Having briefly discussed the various features relating to management functions, I will now discuss the main management functions and explain how they affect completion time of building projects.

2.5 MANAGEMENT FUNCTIONS

Together, researchers have come out with a number of management functions ranging from between four to seven. For instance whilst Mullins (2002) enumerates four functions, Sharma (2001) enumerates seven and others such as Schwartz (1980), Turkson (1997) and Kerzner (2003) mention five. Analysing these works may sound contradictory but the ideal thing is that, regardless of the number, all the scholars talk about the same functions with the only difference being that, those with lesser numbers discuss the other functions as sub functions. An example is that in Sharma's seven functions, he mentions planning, organising, staffing, directing, controlling, coordinating and communication. Schwartz and Kerzner's five functions also includes; planning, organising, staffing, directing and controlling. It may look like Schwartz and Kerzner excludes coordinating and communications but they are covered as sub-functions under organising and directing respectively. However, the main functions that run through most literature are the five main functions developed by Fayol in 1916 and they are:

1. Planning
2. Organising
3. Staffing
4. Directing and
5. Controlling

The discussion below now focuses on these five main management functions and how each of the parties in the building project team (Client, Consultants and Contractors) practice these functions in a project to achieve project success with particular reference to the time constraints on projects. These functions do not strictly follow each other, thus when one is being performed the others may still be ongoing.

2.5.1 Planning

Many authorities in management regard planning as the first management function while others hold a contrary notion and regard decision making as the first management function. Those who argue that the first management function is planning support their stand with the argument that planning begins with decision making (Turkson, 1997). In general, to plan means to set goals or objectives, and then develop methods of achieving them. It therefore involves making decisions, forecasting and making major and minor plans. In building projects, planning is a fundamental and challenging activity. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. Generally, it concerns completing a project in the shortest possible time compatible with economy and quality.

The planning process begins with what is generally termed in project management as “the input” which is a want or a need. The process also forms the skeleton of the whole project. Therefore, without adequate planning, building works will be done haphazardly and this may not help the achievement of time target. For instance, the planning stage is where decisions about the establish relationships between project participants are taken. All these indicate that planning is the backbone of the success of any building project. It is, therefore, not surprising that Hendrickson (2003) concluded that developing a construction plan is a critical task in the management of construction, even if it is not written and that a good construction plan is the basis for developing the budget and the schedule of work.

There are two main levels of planning associated with building projects. These are strategic and operational planning.

- Strategic Planning - Strategic planning deals with the high-level selection of overall project objectives, including the scope, procurement routes, time-scale and financing options. Strategic planning for building projects results in broad outlines of what the project has to achieve and how it is to be achieved. It also involves prioritizing of objectives.
- Operational Planning - Operational planning involves the establishment of method statement for each activity. Operational planning allows a more detailed look at the project’s resource requirements that is not obvious at the strategic level. Examples of operational plans include a tender plan, feasibility plan and construction plan (Harris and McCaffer, 2005).

2.5.1.1 Client

The client's involvement in planning depends on the type of procurement system/arrangement in use and the phase of the project. In general, regardless of the procurement system/arrangement in use, the planning stage for the client begins with "the input" which is a want or a need. From the definition of planning, that is to set goals or objectives, and then develop methods for achieving them. The client's major goal is to have a building within the four major constraints of time, cost, quality and safety. The client will, therefore, be involved in strategic planning instead of operational planning. Decision making by the client is a major element in construction. In a research conducted by Nick G. et al (2004), it was found that client indecisiveness and non-uniformity is a major factor on project success especially time. In the case of the corporate client, it plans on how to superimpose the project plans on its organisation plans (Maylor, 2003).

2.5.1.1.1 Pre Contract

At the pre-contract stage, the client, irrespective of the procurement system being used, the client thinks about what to build(briefing) how(choice of consultants), cost(financial arrangement), its benefits(returns in investments),etc and plans on how to finance the project, the total duration of the entire project and quality of the building (Ashworth and Hogg, 2001).

The clients planning also include decision making on trade-offs between the three main constraints. A trade-off is the prioritization of the constraints (time, cost and

quality) of the project. This is a major decision to make in planning by the client since it greatly affects the completion time of the project. This decision is needed in making compromises during construction phase of the project especially in the case of unforeseen occurrences, this decision will help to know what constraint to move and what not to move (Maylor, 2003).

2.5.1.1.2 Post – Contract

At This stage, the client's involvement in planning depends a lot on the planning of the consultant and the contractor. From the plans of the other parties, the client develops an operational plan indicating when to make money available and also when to communicate his/her needs for changes in design and when to be present for site meetings (Harris and McCaffer, 2005). Any default by the client in any of his/her functions affects the completion time of the project as client indecisiveness and inconsistency affects project success. Failure to plan when to communicate changes in design also affects the completion period of projects. A lot of research works has identified failure to pay contractors on time as one of the major factors affecting delays of building projects (Oppong, 2003). It can, therefore, be deduced that if clients plan well and pay on time, production delays will be minimized. All the planning stated above are irrespective of the procurement system in use.

2.5.1.2 Consultant

The planning activities of the consultants also depend on the phase of the project and the procurement system in use. In general, the consultant plans strategically and

operationally. It is the responsibility of the consultant to prepare plans for use by the client in taking strategic decisions.

2.5.1.2.1 Pre-Contract.

Planning requires that the project manager or lead consultant decides on people, resources and budget required to complete the project. The overall project plan is prepared by the consultant during this phase of the projects using the various planning techniques. The consultant team decide; on how to break up project into manageable phases, what to deliver in each phase, and decide the composition of the project team.

Although the staffing of the design team is also another management function, it is said to be part of pre-contract planning activities (Schwartz 1980). Therefore, having selected the design team, which usually comprise of individual firms coming together for the purposes of the building project, each member of the team at This stage plans his/her activities to superimpose the project objectives in their companies' activities (Ashworth and Hogg, 2001). The major activities of the consultant at this stage to be planned include: investigations, design calculations, drawings, statutory planning approvals, preparation of specification, preparation of contract document, tender programme and preparation of quality systems (Harris and McCaffer, 2005). These activities are adequately planned using the various planning techniques to avoid delays during the construction stage and all of these activities should be done in the pre-contract stage.

2.5.1.2.2 Post-Contract

After the contract has been signed the main activities of the consultants include supervision and controlling, hence, the planned activities prepared by the consultant during the pre-tender stage is used to monitor the project to avoid time and cost overruns. However, due to unforeseen circumstances, such as external factors and further decisions made by the client, the plan may need adjustment and certain parts of the plan will have to be detailed. These further adjustments to the plan are carried out during the post- contract phase of the project (Harris and McCaffer, 2005).

2.5.1.3 Contractor

The contractor's organisation is one of the three building project parties that have historically put greatest effort into the planning process because the results of a well planned, carefully monitored and controlled contract reflect in the profitability of the contractor. With the benefits of planning clearly visible, it is not surprising that effort is made to ensure adequate planning. The contractor's planning efforts are divided between planning at the pre-contract and post-contract stages. Planning to the contractor evaluates the use of resources in terms of time (Harris and McCaffer, 2005).

2.5.1.3.1 Pre-Contract

In the traditional procurement system, the involvement of the contractor begins from the time the contractor buys the tender documents and therefore, is not involved in the design stage of the contract. For such a contractor his/her activities in the project at

the pre-contract stage begin at the time the tender is bought to the time the contract is signed. The planning activities here evolve around the decision to tender. Responding to such a decision means the contractor's construction firm must assess the firm's current workload, availability of resources in terms of finance, staff and labour. A proper study of the tender documents to see if they can meet all the conditions for the project, knowledge of consultants, client and nominated contractors and suppliers, the contract size, type, nature, value and location of project, etc. A decision to tender considering all the relevant factors marks the beginning of the planning process for the contractor. The pre-contract planning also involves aspects of operational plans, such as preparing draft plans or programme, method statement and setting up an estimation team to prepare estimates. The contractor at this stage needs to prepare a project plan that is superimposed on the company's plan. The plan prepared at this stage should be able to determine the labour and cost requirement at each time of the project to prevent shortage of labour, cost and material which will result in delays. The contractor finally put everything in place in order to be able to meet the goal of finishing the project successfully on time and maximize profit.

With regard to the project management procurement arrangement, the planning activities are the same, as in the case of the traditional system. The major difference in the activities is the role of the management contractor. The planning activities at the pre-contract stage for the management contractor begin at the design stage where the contribution of the contractor on buildability is essential. The management contractor is responsible for maintaining the relationship with all the works contractors to ensure the smooth and timely completion of a project. The planning for the management

contractor involves the preparation of a works program with emphasis on when the various works contractors will be involved without exceeding the completion period (Buehring, www.articledashboard.com).

2.5.1.3.2 Post-Contract

After the signing of the contract, the site is usually handed over to the contractor. The articles of agreement and conditions of contract for building works (fifth edition 1988) by the Republic of Ghana, requires the contractor to prepare and hand over a master works program for the project. The contractor at this stage needs to prepare monthly, weekly and daily works programme for site usage for effective control. The contractor needs to also plan on how to effect changes on the works programme in case of unforeseen occurrences. For the management contractor, he prepares a master plan from the individual plans provided by the various works contractors and uses it in controlling and coordinating the activities of the works contractors (Buehring, www.articledashboard.com).

The major planning activity for the contractor is developing a works programme. A works programme is a schedule of activities showing the entire project task and their estimated durations. The plan is able to determine the sequence of task, critical activities, identify buffers, and the like. A good programme is able to assist the site manager to determine their resource and also used for monitoring and controlling of building project. Also a good plan is the one that can facilitate the development of a human resource and cost plans. There are several techniques used in the preparation of plans. Examples of such techniques are:

1. Bar-charts and Link bar charts- It is the most widely used and easily understood by all. It has a short fall of not being able to determine critical activities
2. Network Analysis: Activity on the node and Activity on the arrow
3. Line of Balance: For repetitive works
4. Programme Evaluation and Review Technique (PERT)
5. Space Time Diagram
6. Computer Software: Examples; Microsoft project and Primavera

The construction industry has a poor reputation with regard to achieving building project completion date; therefore the selection of the appropriate technique will allow the project to be properly controlled in terms of time (Ashworth and Hogg, 2001; Harris and McCaffer, 2005).

2.5.2 Organising

To organise means to put in a state of order, that is to arrange or constitute into a coherent unity in which each part relates to each other part. It involves deciding how the work is to be divided and coordinated. It also deals with discussion on labour and allocating them to the appropriate person or group of persons, defining their responsibility, accountability and the extent of their delegation. It involves proving coordination of authority relationships. Organising establishes the framework in which responsibilities are defined and lines of authority are laid down for the achievement of project goals. Organising interacts with the performance of the other

management functions for the execution of building projects (Mullins 2002; Turkson 1997; Schwartz 1980).

Coordination as already explained is regarded in this work as a sub function of organising just as Schwartz (1980), Turkson (1997) and Kerzner (2003) did, hence coordination activities are also discussed as part of organising activities. From the above, the activities involved in organising may be summarised as follows:

- Designing an organisational structure: This involves determining how people, tasks, technological and material resources should be grouped and also deciding on the type and number of sections which should be part of the organisational structure design.
- People required to fit into the organisational structure: When an organisational structure is designed and grouped into various sub-divisions, the next stage is the type of people required to fit into the structure. This is the staffing function of management and would be discuss later.
- Allocation and assignment of roles and responsibilities: This stage of organising tells people what they are to do, how to do it, when to do it, and where to do it.
- Establishing standards of performance: To ensure that people are doing what is expected from them, performance standards should be set for them to determine the degree of conformity or deviation from standards set. More especially time standards.
- Coordinating the work of all individuals and sections so that the building is constructed within the stipulated time.

Organising can be relatively simple or it can be enormously complex. It is essential in managing because, without it there would often be chaos (Schwartz, 1980; Turkson, 1997). Building projects organisation is a coalition of a temporary set-up. The parties involved are from different organisations, therefore the parties need to organise both their individual firms/organisations and that of the project. The collection of individuals on temporary basis makes the organisation of building projects complex. This complexity is also due to the uniqueness of every building project and the fact that feedback cannot be used on the same project team since the team is disbanded after the execution of the project (Maylor, 2003). In the organisation of a project, the major aspect is the development of the organisation structure.

2.5.2.1 Organisational Structure

The organisation structure is a structure designed to show the lines of responsibilities, lines of communication, determine relationships and roles. The organisation structure developed or designed for building projects are temporary. Unless a consortium, the parties forming the building project team have their individual firms, therefore the duties performed by participants representing the various parties are usually divided for a project, such that the participants may be involved in other projects and may not be fully committed to the project in question. Due to the temporary nature of projects, the structure usually recommended is that of the matrix /mixed structure. The matrix structure incorporates the features of a building project and therefore seems to be the best structure. The procurement system being for the building project may be used as the basis for developing the organisational structure. (Maylor 2003; Mullins 2002).

Fig. 2.3 is an outline of a matrix structure using the project management procurement arrangement as basis.

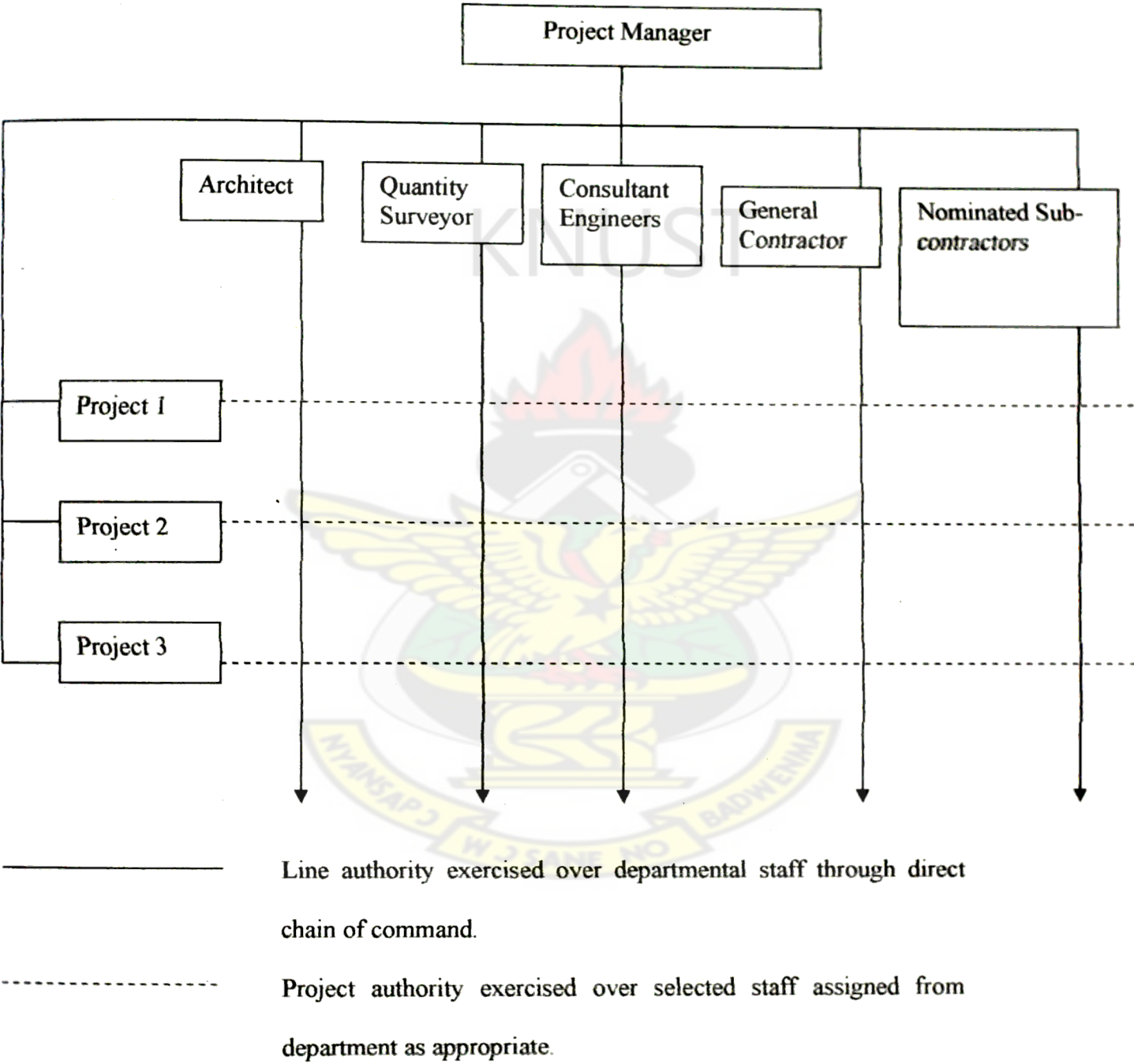


Fig 2.3 Outline of matrix structure (Mullins 2002).

Since coordination is being discussed as a sub function of organising, it will be discussed in detail before considering parties activities involved in organising which will include coordination activities as well.

2.5.2.2 Coordination

Coordination means to organise the different aspects of a project to make sure they all run efficiently. In general, coordination represents the degree of functional articulation and unity of effort between different entities in an organisation (Georgopoulos and Mann, 1962), and the extent to which the work activities of organisational members are logically consistent and coherent. Coordination is necessary so that proper information is made available at the proper time and to the correct person. It is also essential for arranging the delivery of various items and materials so that the work can progress as planned and a good coordination is essential between various parties working together on the project so that the operation of anyone would not hinder the work of the other (Schwartz, 1980).

Cooperation is another function needed in organising projects. It is usually explained like coordination and has the same effects on project success just like that of coordination. A research work undertaken by Phua and Rowlinson (2004) commented on cooperation as follows: "Cooperation between construction organisations has always been the basis of construction project success". This implies that, just like coordination, without cooperation by the various parties involved in a building project, the project may not be successfully realized at the stipulated time. Currently, authors in the construction management field are at pains to point out that a

cooperative approach between construction organisations would bring about trust and commitment-induced efficiency, and better resource allocation and utilization which lead to increased time management performance on building projects. It seems that regardless of research scope and context, cooperation is consistently imputed to be a vital determinant of construction project success especially the time factor (Phua and Rowlinson, 2004; Latham, 1994).

2.5.2.3 Client

The client is actively involved in the organising function both at the pre and post contract stages of the project. The organising activities of the client are irrespective of the procurement system used. The individual client may not have any organising to do with respect to preparing organisation structures and also he/she may not need to coordinate affairs in the project since that obligation is entrusted to the consultant, although some clients organise themselves to attend meetings, however, the corporate client needs the function of organising in a project.

2.5.2.3.1 Pre-Contract

The corporate client needs to assign personnel from his/her outfit to the project that would make decisions on the project in question. Usually such personnel will be from an estate department of the client. The corporate client may need to prepare an organisational structure which outlines the roles and authorities of the various personnel from his/her outfit assigned to the project. A true reflection of proper

cooperation and coordination between assigned personnel to a project is the timely completion of the building project (Kerzner, 2003).

2.5.2.3.2 Post-Contract

The organising activities involved in the post-contract stage of the client are a continuation of what he/she does in the pre-contract stage.

2.5.2.4 Consultant

The consultant needs the function of organising in both pre and post- contract phases of the project.

2.5.2.4.1 Pre-Contract

Just like the client, the organising for the consultant is in two areas, the individual consultant's own firm and that of the project. A good organisation structure of the individual firms forming the consultant team determines the responsibilities and roles of the personnel assigned to the project (usually a matrix structure). Another organisation structure which is also developed is that for the building project which is rather designed by the project manager or the lead consultant. The organisation structure for the project consultant team members on the project is very essential, since it determines the communication channel for effective flow of information and also gives the job description of each of the members of the consultant team. Lack of any of the structures will lead to disruptions in communication of information which has been identified as one of the causes of project delay (Ahmad et al, 2006).

One of the major organising factors which is essential within the team members of the consultant is coordination. As the members of the consultancy team are from different firms brought together temporarily to carry out a project, coordination is necessary because the team members have diverse objectives, some of them conflicting and they are not fully committed to the project however this is also necessary in consortium. Within the consultants, the project manager or the lead consultant carry the role of coordinating affairs and also ensures that there is adequate cooperation by each party. Other coordination activities include; coordination of designs (i.e. architectural, structural and information services) and coordination of information for BOQ (bill of quantities) preparation.

2.5.2.4.2 Post-Contract

The organising activities involved in the post-contract stage are a continuation of that in the pre-contract stage. In addition, coordination at stage is achieved through regular site meetings, checking the issue of drawn information, checking variation request by consultants and cost checking.

2.5.2.5 Contractor

Just like that of the consultants, contractors too have their own firms and therefore need to organise by preparing organisational structures for their own firm and the project and coordinate.

2.5.2.5.1 Pre-Contract

Regardless of the procurement system in use for the project, the contractor in organising for the project needs to prepare a good organisational structure for the effective running or management of the site. The structure for the site should include artisans and site supervisors, their roles and channels for reporting and communication. At the head office there should be another usually the matrix type that also defines the activities of the contractor's own building professionals. Coordination is also essential for the contractor due to the number of labour force that is involved in constructing the building and also the fact that the contractor's personnel assigned to the project may be assigned to more than one project.

2.5.2.5.2 Post-Contract

At this phase of the project, the contractor only coordinates the activities of artisans, domestic sub-contractors, nominated sub-contractors and nominated suppliers so that the works are carried out in the order as planned. The contractor also coordinates the statutory authorities. Ineffective coordination will cause havoc on the site, as site management have been identified as one of the major factors of delay in Ghana in a research conducted by Oppong (2003). The project management procurement arrangement, have the management contractor or construction manager taking the responsibility of organising the affairs of the individual works or sub-contractors by coordinating activities of the various sub contractors.

2.5.3 Staffing

Staffing is the function of management which deals with the appointment of the requisite number of personnel to perform function as laid down in the organisational structure. It lays down the process by which the persons are selected and trained keeping in mind the volume of work and the available funds. The staffing function is aimed at procuring, developing and retaining the human resources of a project. Human resources are regarded as one of the vital ingredients for the success of every project. It is therefore necessary to institute a process that will ensure that competent and qualified people are employed. Selecting consultants, contractors and suppliers is an exceptionally important part of the staffing function in a building project.

Generally, on a building project, the personnel or participants selection depends a lot on the procurement system being used. The project team is more likely to be effective when it has clear objectives, a well defined task, and a definite end-result to be achieved; therefore the composition of the team is chosen with care. A right person on the right job should be selected very carefully so that the project may not be delayed due to the lack of technical knowledge on the part of a person appointed to fill a position on a building project. The staffing needs of every project must be adequately anticipated in advance to enable competent and qualified personnel to be recruited, hence staffing is carried out in the pre-contract phase of the project to enable their involvement in the pre-contract activities (Turkson 1997; Ashworth and Hogg, 2001)

2.5.3.1 Client

For the client, the staffing function required of him is that of his own staff that link him/her to the consultants i.e. liaison staff. The client does the selection of the consultants and may select the contractor if the contract is a negotiated one. In the traditional procurement system, the client may select the architect who is usually the lead consultant and the other members forming the consultant team through negotiations or competitive tendering or allow the architect to select the other team members forming the consultants. With regard to the appointment of contractors it can be done by the consultants or the client. In Ghana, before the issuance of the Public Procurement Act, 2003 (Act 663), clients could select contractors through negotiations without going through competitive tendering. The Public Procurement Act requires that all contractors be selected through a competitive tendering, either open or selective whose submitted tenders are evaluated and a competent contractor chosen.

For the project management procurement arrangement, the client only appoints the project manager, who in turn staffs the rest of the positions to be occupied on the project. Research has shown that in this procurement system, the most important personnel whose selection could very much effect the project is the project manager. This is because the role he plays is very vital. Therefore a sound qualification of the project manager is a working knowledge of the management processes and understanding of the management functions. Self motivation and the ability to motivate others are very important as is the relationship with those with whom the manager has to work. Own personal goals and moral values coupled with own

attitude to work and that of others also need to be considered. The response to the various aspects of the project will vary depending on the project managers own professional allegiance. The project manager to be selected therefore needs the following skills:

- Appropriate knowledge - The project manager is required to have a good balance of both technical and managerial skills.
- Technical knowledge - There is something unique about the building industry and project management within it is a rather specialised form of management. Ideally therefore the project manager will already be a member of one of the building professionals. An understanding of the process and the product of construction, and a working knowledge of the structure of the industry, will clearly be advantageous if not essential. The importation of managers with no knowledge of the industry or its working has drawbacks and their appointment should be approached with caution.
- Management skills - A good understanding of the management functions.
- Leadership qualities - Since the project manager will be leading the team; he needs to have good leadership qualities.
- Clarity of thoughts.
- Effective delegation.
- Decision making etc (Ashworth and Hogg, 2001).

2.5.3.2 Consultant

In both procurement systems, the lead consultant may be the one who appoints the rest of the consultant team. This is an important function; therefore the appointment

should be done with care. The incapability of any of the team members technically, may affect the completion time such that wrong decisions made would have to be rectified later, hence delaying the building project (Ahmad et al, 2006). The consultants also appoint the contractor through competitive tendering as have already been discussed. They also appoint nominated subcontractors and suppliers as well. As already noted, each of the consultants works in their own respective firms aside the project, therefore in their respective firms there is appointment of personnel to handle the various building projects depending on their experiences and current workload (Maylor, 2003).

2.5.3.3 Contractor

Irrespective of the procurement system, the contractor needs to staff his/her construction team by appointing the labour force needed on the project such as artisans and supervisors. Another appointment of personnel needed by the contractor is that of domestic sub-contractors and suppliers. If management contractors are involved, then it is the duty of the management contractor to appoint the works or sub-contractors and suppliers.

2.5.4 Directing

Communication and motivation are considered as sub functions under directing as was by Schwartz (1980), Turkson (1997) and Kerzner (2003), hence the discussion on directing will regard motivation and communication to be inclusive in the directing function. Directing is a management function which involves guiding, supervising, motivation and leading all the parties on the project. This is achieved by establishing

effective communication between the parties to make all aware of the aims, programme and performance of the building project. In performing the function of directing, the project manager seeks to motivate people to perform activities in the most efficient manner possible, to lead and inspire people toward project goal achievement (in This case completing on schedule) and to communicate information about how activities should be performed.

In construction organisations, managers at every level, perform the function of directing. The other parties are made aware of planned programmes in the form of bar-charts/network diagrams, drawings, estimates, specifications and other details of the work. The object of directing is that each party of the project should know exactly what he is supposed to do, how and when to do it. The major elements of directing are leading, motivating and communication (Schwartz, 1980; Mullins 2002; Turkson 1997).

2.5.4.1 Leading

To lead is to induce people to achieve goals willingly and harmoniously. Leading means inspiring confidence and trust in the subordinates by their superiors. Leading involves giving directions to subordinate staff about what they should do, how and when they should do it. Leaders in a project are appointed. The ability to lead, or leadership is particularly necessary in building project management because people in most situations cannot be forced to perform or cooperate (Schwartz, 1980). Leadership is related to the other two functions, motivation and communication (Mullins 2002).

Every leader should possess certain unique qualities. Lord Montgomery, in his/her book, *Path to Leadership* describes a leader as one who can be looked up to, whose judgement is trusted, and who can inspire and warm the hearts of those he leads, gaining their trust and confidence and explaining what is needed in language which can be understood. Before one can effectively lead a building team, he needs to adopt a leadership style to enable him get the right impact on the other team members. There are a lot of approaches in defining leadership styles but the main ones that run through all the approaches can take one of three forms- the authoritative leader, the democratic leader and a situational leader. The authoritative leader gets things done through people by the use of threats and force. Such a leader imposes his/her authority on his/her subordinates and does not give them the chance to express their opinion on issues. On the contrary, a democratic leader is one who uses persuasion, coaxing, appeals and considers the feelings and opinions of persons and encourages their participation in collective decision-making. The third is situational leadership, where the leader adjusts his/her leadership style to suite the situation arising (Mullins 2002, Turkson 1997). Kelley (2006) commented that the situational leadership approach is the best leadership style for project management.

2.5.4.1.1 Situational Leadership

The rise of the “situational” approach focusing on the relationship between a specific circumstance and leadership is a result of diverse and often conflicting demands on the manager. The underlying question is whether a manager is capable of altering his/her leadership style to match the shifting environment as the project progresses

through its life cycle. Behaviourists such as Blake and Mouton (1985), Reddin (1967) and Adair (1973) argued that it is possible to change style to match the situation while Fiedler (1964) was among the first of the contingency theorists to disagree. From his/her research, Fiedler (1964, 1967, 1970, 1995) sees the two main characteristics of a project manager as being “relationship-motivated” or “task-motivated”. Other writers such as Mitchell (1987), Spector (1989), Knopp (1992) and Clift and Vanderbosch (1999) are in agreement with Fiedler’s assertion. This implies that the project manager should seek to select the situations that would best match his/her own inclination or style, and to avoid projects that are likely to present him/her with situations that are counter to his/her default preference. As the project manager’s role is to marshal the commitment of his/her team members towards a concerted effort of delivering the building project on time (Fiedler and Chemers, 1984). It would seem logical for managers who know their own styles to aim to acquire and maintain a level of control consistent with achieving the results that are expected of them. Project success, therefore, is dependent on situational control in terms of the leader-member relationship, task structure and power position although the causality between leader style and these characteristics has yet to be determined (Clift and Vanderbosch, 1999). Choosing the wrong leadership style may affect a project time because the project leader may not use the best medium to achieve the best from workers and this can produce more idle time on a project.

2.5.4.2 Communicating

To communicate means to impart, to make known, and to inform. It is considered as an art; it may involve giving instructions, issuing work orders, discussing plans, explaining results to people and in other ways passing intelligence through the project. Communicating is a difficult function for two main reasons. First, it is hard for people to express-whether by speaking, writing, or using symbols or body language-precisely what they think and what they want done. Since communicating is an art, no one is able to reach perfection in expression. And when workers do not understand their jobs or when managers at one level receive confusing directives from a higher level, trouble may result. Secondly, many problems arise in communicating because of tremendous competition for attention. Distractions such as noisy machines, telephones and movement of people often make it difficult for managers to explain what they mean. Due to these distractions, the function of communicating may give some project managers more problems (Schwartz, 1980).

Another major problem with communication is the timing. If recipients of information do not receive it on time, the message loses its function. Poor timely communication of information was identified as one of the factors causing delays by Ahmad A.O. et al. in 2006. Effective management exist only with continuous communication and feedback for control processes. There will be no control or coordination without effective coordination (Sharma 1985). The lack of communication richness in technology-supported communication also affects the ability to coordinate work (Galegher and Kraut, 1994), as do time delays that occur when communicating solely through technology (Robey et al., 2000). Thus, team members are generally more

likely to report difficulty in coordinating work activities because of communication constraints (Chidambaram, 1996; Galegher and Kraut, 1994; Hollingshead et al., 1993). Effective communication is a fundamental factor that construction alliances must implement for project success (Eddie W.L. et al. 2001).

2.5.4.3 Motivating

To motivate is to stimulate active and enthusiastic interest in what is being done. Motivation is the act of inducing a person to do something. It is also a process of influencing project participants to strive toward the achievement of project goals (Turkson 1997). Mitchell defines motivation as the degree to which an individual wants and chooses to engage in certain specified tasks. There have been developments of so many theories of motivation, with all of them trying to determine the best way to motivate workers. Among such theories are Maslow's hierarchy of needs, Alderfer's modified need hierarchy, Herzberg's two-factor theory, Vroom's expectancy theories etc. All these theories try to look at how people should be motivated, but any individual would be better motivated if his/her needs are identified and met. The various needs and expectations at work can be categorised in a number of ways but they can be grouped into intrinsic and extrinsic motivation.

- Extrinsic motivation is related to tangible reward such as salary and fringe benefits, security, promotion, contract of service, the work environment and conditions of work. Such tangible rewards are often determined at the organisational level and may be largely outside the control of the project manager.

- Intrinsic motivation is related to psychological reward such as opportunity to use one's ability, a sense of challenge, achievement, receiving appreciation, positive recognition, and being treated in a caring and considerate manner. The psychological rewards are those that can usually be determined by the actions and behaviour of the individual manager (Loosemore et al., 2002).

In a project, participants need to be motivated especially during unforeseen occurrences so that the project goals will still be achieved. If projects are running behind schedule, one of the controlling techniques could be motivation of participants to work overtime to keep the project on schedule.

2.5.4.4 Client- Pre and Post Contract

Since the client does not lead the project team, the directing functions expected of him is communication and motivation. The client directs his/her own in house staff i.e. liaison staff. Regardless of the project phase or procurement system being used, the implementations of these functions are the same. It is known in building construction that the client usually makes decisions in the course of projects which affect the design of the structure. Therefore, to effectively carry out the client's wishes, the information or decisions made, need to be communicated effectively to the consultant to be able to implement them. The timing of such decisions should also be considered by the clients. Making certain decisions at certain stages of the construction, may call for the undoing of certain works already put in place and this will affect both time and cost.

During motivation, depending on which constraints of the project is essential to the client, whether time, cost or quality, the client can motivate the other parties. For instance if his/her priority is on cost he can choose a form of contract such as cost plus contracts and use it as a means to motivate contractors to work within a specific cost. On the other hand if priority is on time, the client can adapt motivational factors or choose contracts with great emphasis on time. Advance mobilisation and payments on time could also be used as motivation by the client. The most important thing is for the client to set his/her priority and identify the various needs of the other parties and use the satisfaction of their needs as motivators (Maylor, 2003; Harris and McCaffer, 2005).

2.5.4.5 Consultant- Pre and Post Contract

The directing duties performed by the consultant are the same at every phase of the project and under every procurement system. Communicating the wrong information at the wrong time and not using the best medium of communicating may affect effective coordination and controlling of projects. Making sure that all the necessary information are communicated effectively and timely, are some of the major duties of the project manager or lead consultant, since he coordinates all the participants on the project. Again the project manager or lead consultant is also responsible for motivating the other consulting team members, contractors and suppliers to achieve the project time goals. He also has to identify their needs and try to use them as motivating factors (Mullins 2002).

2.5.4.6 Contractor- Pre and Post Contract

The contractor's directing functions are irrespective of the phase of the project and the procurement system being used. The contractor is responsible for leading his/her own construction workforce both on site and in the office. He does so by choosing a suitable leadership style. He also motivates his/her own workforce to work toward achieving project time goals. A lot of motivation is needed by the contractor since it is his/her work force that put the project into reality, therefore any inadequacies on the part of his/her workers will make the project run behind schedule. Most contractors motivate their workers when they are behind schedule and this controlling device helps them put the project back on schedule. Not only does the contractor effectively communicate information to other parties involved in the project, he also ensures effective communication among his/her workforce and especially information from site to the office and vice versa (Mullins 2002).

2.5.5 Controlling

The control function is an activity concerned with checking to ensure that plans have been carried out and deviation from set plans attended to. Thus it is a managerial function concerned with measuring performance in relation to expected standards of performance. This function of management measures actual progress achieved on a project and compares it with the planned program at regular intervals and also identifies areas of deficiency if any so that remedial steps can be taken in the course of the project.

The control function involves three steps which strictly follow each other. These are:

- Setting standard for work performed - In a project these standard can be the planned program of activities for time, or budget for cost and the quality requirements of the building.
- Measuring performance against standards - The objective of measurement is to answer the question “How well are we doing in meeting the standards set for our activities”. This can be done by developing control system that can help to monitor or detect faults. The basic requirements of the control system include:
 - i. Defining system characteristics of importance
 - ii. Defining limits to their variation
 - iii. Measurement of those characteristics
 - iv. Making progress visible
 - v. Feedback to team of performance
 - vi. Instituting corrective action where required.

Note should be taken that the system cannot decide on the best management decision to correct a problem

- Taking corrective action as needed- To correct is to amend, remedy, rectify, or in some other way make right what is wrong.

Controlling also involves the application of reward and disciplinary measures depending on the achieved performance. Controls should always be set in relation to the nature of the job and certain personality characteristics. Controls should be simple and easy to understand (Turkson, 1997; Maylor, 2003; Harris and McCaffer, 2005; Schwartz, 1980). In a building construction project the main aims of controlling are:

- (1) To complete each activity within the time allocated to it, a watch over the progress of each activity should be kept.
- (2) To control the quality of work as per specification.
- (3) To avoid any wastage, the use of materials, machines and output of the labour should be controlled.
- (4) To keep the cost within the estimated cost, the expenditure on each item of the work should be controlled.

Although cost and quality may seem to be independent, ineffective control of these two constraints can also affect time. For instance, if a country faces unstable inflation, contractors may choose to buy materials only at a particular period in order to get the lowest price. The period at which he may decide to buy the materials may be behind the actual timing planned and this will evidently affect the completion time. Another example is that, preference on a particular specified quality of material may cause for waiting since the particular material ordered may not be available at the time needed and the material cannot be substituted for any other. The waiting period may delay the project. During the execution of a building project, control is carried out in both phases of the project. The control of the constraints is the same for each phase of the projects. The procurement system in use only determines who performs the controlling function. Apart from that the measures of control are the same for each procurement system.

2.5.5.1 Client- Pre and Post Contract

The client is involved in the controlling process by making decisions and effectively communicating adequate information on targets/standards to which performance can

be measured to. The client does the controlling of his/her own liaison staff. Not giving adequate information may result in ineffective controlling. When performance does not measure up to standards the client can help by motivating other parties involved in the project to work towards rectification. This motivation can control cost, time and quality (Maylor, 2003).

2.5.5.2 Consultant- Pre and Post Contract

The lead consultant, being the leader of the building project team carries the burden of controlling building projects. In order to do that he/she puts in control systems suitable for the project to effectively monitor the progress of works. He/she is responsible for monitoring and controlling. Building projects are mainly controlled from the main areas of cost, time, quality and safety. Although, our main concern is time, it has been established that effective control of cost and quality enhances timely completion of projects. These are briefly discussed as follows:

2.5.5.2.1 Cost Control

It should be recognised that the various cost control systems such as; Overall Profit and Loss, Unit Costing, Profit and Loss on Valuation, and the like only provide paper work. It should also be recognised that no amount of paperwork achieves this control. The paper work can only provide guidance on what control actions should be taken.

2.5.5.2.2 Time Control

The programme of works or plan can also serve as a time control system, such that at the end of each day one can easily detect whether or not the project is on schedule as planned. The bar chart is a very good planning technique in measuring progress. Similarly, the plan can only provide guidance on how the work is progressing but not on how to bring back a project on schedule. In such situations the consultant can focus his/her attention on the activities of all the parties and how best to control time. It is essential to know that the major management function that affects the completion time of projects is the control of time. This is because; This is the only function that ensures that the project is always on schedule (Harris and McCaffer, 2005).

2.5.5.2.3 Quality Control

Acting on the client's emphasis of quality (specifications) can serve as the standard or system to use in controlling quality. Much will depend on the selection of the contractor and consultants, taking into particular consideration, the professional capabilities. Not having skillful members on the building project team can affect the setting of standards for quality. Selection of parties on a project team is also part of the management functions namely staffing. It implies that management functions also affect quality which in turn affect the time since works not controlled well may have to be redone (Ashworth and Hogg, 2001).

2.5.5.3 Contractor- Pre and Post Contract

The contractor also engages in the control of quality, time and cost. The contractor in controlling also uses the systems mentioned above. The quality of a building is mainly

dependent on the contractor. A good contractor should, therefore, seek certification on quality assurance from respectable quality certifying bodies to always assure clients and consultants of delivering quality buildings and also work hard towards ensuring the usage of quality materials and labour force. In terms of cost the contractor can also use the appropriate control systems. Contractors are the main influences when it comes to controlling time on project which happens to be the main focus of this study. Any relaxation on the part of the contractor in monitoring project progress may cause delay. It is therefore, necessary that the contractor uses planning techniques which can easily detect critical activities on a work programme so as to ensure that he/she does not exceed any of the stipulated time for the critical activities. However, if due to unforeseen circumstances the critical activities are exceeded, effective controlling actions such as crashing activities by the usage of buffers and motivation to bring the project on schedule and always ensure that the project is always on schedule are required (Harris and McCaffer, 2005).

Controlling of time for building projects is also important to the contractor not only to avoid delays but also to avoid unnecessary cost. As the project delays, inflation may set in and prices will rise and if it is the fault of the contractor, fluctuations will not be paid and he will also be charged for liquidated and ascertained damages. Completing a project ahead of schedule provides savings for the contractor (Maylor, 2003; Republic of Ghana Articles of Agreement and Conditions of Contract for Building Works, 1988).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

The main method used for this research is a literature review and a survey using questionnaires. The review was an integrative review, which aims at summarising past research by drawing overall conclusion from separate studies that are believed to address related or identical hypothesis.

The literature review was gathered from worldwide academic journals and books. The other instrument, which is the questionnaire was designed and administered to clients, consultants and contractors to solicit information on how management practices affect completion time of building projects. The results were analysed.

3.2 DATA COLLECTION

Questionnaires were sent personally and through mail to:

- ♦ Clients –This includes public, corporate and individual clients.
- ♦ Contractors –The target group was those categorized under D1K1 classification of the Ministry of Works and Housing.
- ♦ Consultants – Selected from architectural, engineering and quantity surveying firms.

3.3 SAMPLING

Due to the absence of undefined population size of clients, time and financial constraints for this research, a total sample size of fifty (50) was decided on for clients. The Kish formula was used to determine the sample size for the consultants using the 2006 published list of professional bodies of architects, engineers and quantity surveyors. After efforts to get the current list of D1K1 contractors from the Ministry of Works and Housing have proved futile, the 1998 list of contractors from the Ministry of Works and Housing was settled on. The sample size was determined as follows:

Kish formula

$$n = \frac{n^1}{1 + \frac{n^1}{N}}$$

$$\text{Where } n^1 = \frac{S^2}{V^2}$$

N = Total population

V = Standard error of sample distribution = 0.05

S = Maximum standard deviation of the population element, total error = 0.1 at a confidence level of 95%.

$$S^2 = P(1-P) = 0.5(1-0.5) = 0.25$$

P = The proportion of the population element that belong to the defined class

Contractors

$$N = 96$$

$$n^1 = \frac{S^2}{V^2}$$

$$V^2$$

$$= \frac{0.25}{0.05^2} = 100$$

$$0.05^2$$

$$n = \frac{n^1}{1 + \frac{n^1}{N}}$$

$$1 + \frac{n^1}{N}$$

$$N$$

$$n = \frac{100}{1 + \frac{100}{96}}$$

$$1 + \frac{100}{96}$$

$$96$$

$$N = 48.9 = 49$$

Consultants

$$N = 293$$

$$n^1 = \frac{S^2}{V^2}$$

$$V^2$$

$$= \frac{0.25}{0.05^2} = 100$$

$$n = \frac{n^1}{1 + \frac{n^1}{N}}$$

$$1 + \frac{n^1}{N}$$

$$N$$

$$n = \frac{100}{1 + \frac{100}{293}}$$

$$1 + \frac{100}{293}$$

$$293$$

$$N = 74.55 = 75$$

From previous work done (Osei Tutu, 1999; Oppong, 2003), a response rate of 20% was assumed and catered for in the sampling. Therefore the actual sample sizes taken are:

Consultants = 90 and Contractors = 60.

Due to the time and financial constraints of the research, not all the sampled number of questionnaires were distributed. The table below gives detailed information on the number sampled, issued and responded number of questionnaires.

Table 3.1 Sampling Detail

	Population	Sample size	No issued	No responded	Percentage of response
Client	-	50	43	32	75%
Contractor	96	60	51	37	73%
Consultant	293	90	77	41	53%

3.4 DEVELOPMENT OF QUESTIONNAIRE

The questionnaires were divided into three sections. The first section was to find out whether respondents have ever encountered any delay in their work and how they managed the delay. The second section contained fifty listed management induced factors of delay. The respondents were to measure the level of importance of each of the factors using a scale of 0-5 with 1 being the weakest, 5 the strongest and 0 non applicable. The last section of the questionnaire was sub divided into three different sets, one each for the three parties (clients, consultants and contractors). All the three sets in the last section were aimed at seeking information on how respondents managed, minimized or avoided the management factors causing delays.

3.5 METHOD OF ANALYSIS

The analysis was carried out statistically and descriptively. The analyses were carried out with relevance to the aim, objectives and hypothesis of this research.

The main statistical tools used for analysing the research were:

1. Microsoft Office Excel (Excel 2007)
2. Statistical Package for Social Sciences (SPSS 11).

The main methods used were:

1. Relative Importance Index- This was used to rank the management practices to determine the strongest practices.
2. Logit Regression Module- This was also used to determine the significance of the strongest practices.
3. Cross Tabulation- This method was used to determine whether the responses varied from the client to the consultant and the contractor.
4. Frequencies and Percentages- The method helped in the descriptive analysis.

CHAPTER FOUR

4.0. ANALYSIS OF RESPONSE

4.1 INTRODUCTION

The analysis for the research was carried out statistically and descriptively. The main statistical tools used for analysing this research were:

1. Microsoft Office Excel (Excel 2007)
2. Statistical Package for Social Sciences (SPSS 11) and the main methods used were:
 - a. Cross tabulations
 - b. Relative Importance Index and
 - c. Frequencies and Percentages

The analyses were carried out with relevance to the aim, objectives and hypothesis of this research.

4.2 ESTABLISHMENT OF PROBLEM

Results gathered from the survey revealed that the probability of a delay occurring in a building project was 89% (Fig. 4.1). Findings from respondents also revealed five major ways of how delays were managed. Three out of these five ways were management oriented (Fig. 4.2). These findings indicate that management practices contribute to delays.

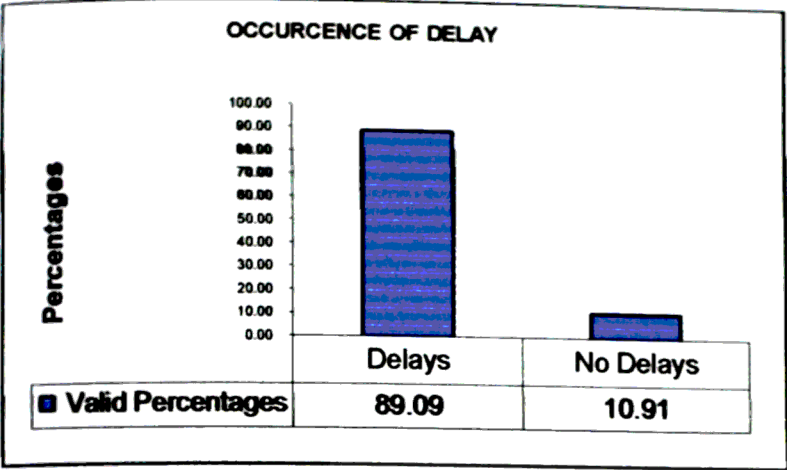


Fig. 4.1 Likelihood of the occurrence of delays on a building project

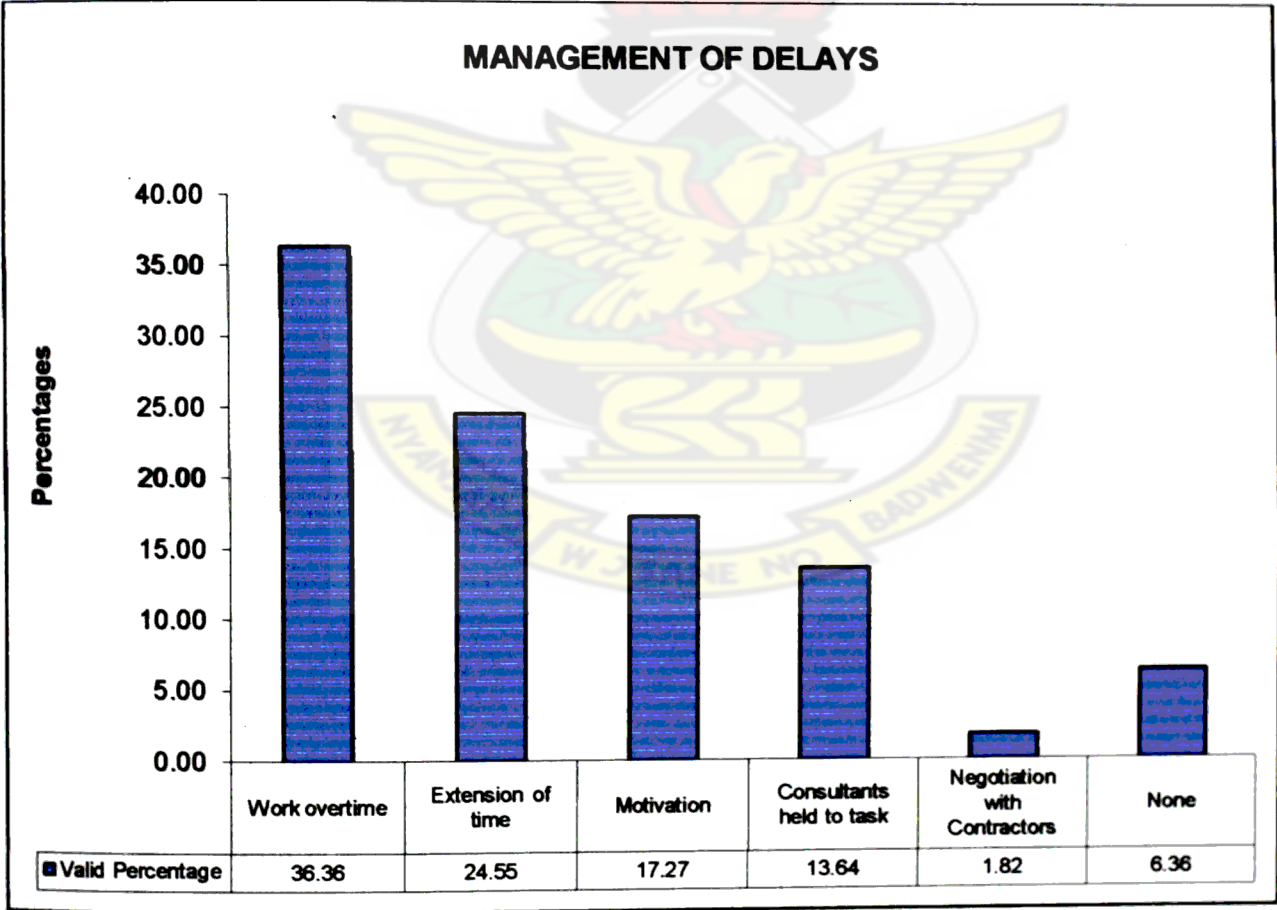


Fig. 4.2 Major ways in which respondents managed delays.

4.3 IDENTIFICATION OF MANAGEMENT PRACTICES WITH STRONG EFFECTS
ON COMPLETION TIME

Fifty management practices that have effect on completion time (factors) were identified from literature. These factors were assigned a management function as can be seen under the remarks column of Table 4.1. The assigning of management functions was subjective. This is because one practice can be classified under one or more management functions. Therefore the function under which the practice is most likely to occur was used. This study therefore had this subjective classification as a limitation in order to reduce the complexity of the analysis and to meet the time constraint on this study. The fifty practices were ranked by respondents on a six point scale. These factors were analysed to find out which of them had the strongest effects on completion time or delay. The relative importance indexes (RII) for the fifty were calculated. These indexes were used to rank the fifty management practices (factors) to identify the ones that had the strongest effect on delay. The mean and standard deviation of each factor were not suitable for overall ranking of the factors because they do not reflect the relationship between them. Also the RII have been used by a number of researchers to carry out similar analysis. Examples are Shash and Nadei (1992) to determine factors affecting contractors mark up, Kometa et. al (1995) to quantify client generated risk and Oppong (2003) to determine the causes of delays in Ghana. The formula used for calculating the RII was:

$$RII = \frac{\sum W}{S \times N}$$

$\sum W$ = Summation of weighting given to each factor

S = Highest weight (i.e. 5)

N = Total number of respondents in the sample

In the calculation of the RII, although the questionnaires were distributed to three parties in the building industry (clients, consultants, and contractors), they were not separated. Hence the index for a factor is calculated from the response given by all the three parties put together. The Table below shows the ranking of factors using their corresponding relative importance indexes.

Table 4.1 Ranking based on RII

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-27	Poor planning	0	10	3	21	20	56	439	0.798	1	Planning
S2-20	Inadequate contractor experience	0	6	8	22	23	51	435	0.791	2	Staffing
S2-37	Long waiting time for approval of drawings by client	0	4	12	14	39	41	431	0.784	3	Planning
S2-38	Delay in design information, mistakes and discrepancies in design documents	2	2	9	20	36	41	429	0.780	4	Planning
S2-30	Dealing with unreliable sub contractors and suppliers	0	9	9	20	25	47	422	0.767	5	Staffing

Table 4.1 Ranking based on RII (Continued).

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-39	Long waiting time for approval of test samples of materials	2	11	7	8	38	44	421	0.765	6	Planning
S2-14	Poor site management and supervision	4	2	11	20	34	39	415	0.755	7	Directing
S2-33	Inability to follow schedule	0	14	4	26	16	50	414	0.753	8	Controlling
S2-35	Communication of variations in design at inappropriate time	0	8	16	15	28	43	412	0.749	9	Planning
S2-29	Work overload	3	5	17	8	43	34	405	0.736	10	Planning
S2-18	Poor coordination of the project manager for the whole project	0	11	12	19	28	40	404	0.735	11	Organising
S2-5	A job poorly done that must be done over	0	10	17	13	34	36	399	0.725	12	Controlling
S2-4	Unreasonable time constraint set by client	1	7	23	17	17	45	397	0.722	13	Planning
S2-34	Slow decision making by client	2	5	10	25	44	24	396	0.720	14	Planning

Table 4.1 Ranking based on RII (Continued).

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-13	Unsuitable leadership style of contractor/ project manager	4	12	3	23	35	33	392	0.713	15	Directing
S2-17	Poor coordination between design team	2	13	11	19	26	39	391	0.711	16	Organising
S2-50	Lack of authority to make decision	5	11	13	17	25	39	383	0.696	17	Directing
S2-6	Client indecisiveness and non uniformity	1	9	16	26	30	28	379	0.689	18	Planning
S2-28	Too many people involved in minor decision making	6	6	25	17	8	48	379	0.689	19	Organising
S2-36	Lack of effective communication between project team	3	5	21	25	27	29	375	0.682	20	Directing
S2-19	Poor cooperation	1	15	18	12	33	31	374	0.680	21	Organising
S2-12	Lack of technical and managerial skills of the project manager	6	3	24	22	20	35	372	0.676	22	Staffing

Table 4.1 Ranking based on RII (Continued).

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-7	Lack of job information in a ready to use format	9	3	21	22	20	35	366	0.665	23	Organising
S2-16	Non establishment of standards of performance	2	14	9	25	42	18	365	0.664	24	Controlling
S2-32	Lack of project organisation	3	22	11	18	17	39	361	0.656	25	Organising
S2-40	Inadequate design team experience	1	20	21	11	29	28	351	0.638	26	Staffing
S2-15	Poor organisational structure	5	11	17	24	32	21	350	0.636	27	Organising
S2-47	Constant unforeseen interruptions	0	22	7	26	39	16	350	0.636	28	Controlling
S2-44	Changes without client notification/ explanation	2	24	7	17	42	18	347	0.631	29	Directing
S2-48	Lack of qualified manpower	1	13	12	47	16	21	347	0.631	30	Staffing
S2-21	Improper detailing	13	5	16	20	38	18	339	0.616	31	Organising

Table 4.1 Ranking based on RII (Continued).

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-43	Low commitment to project objectives	10	11	18	19	28	24	336	0.611	32	Organising
S2-49	Lack of employee discipline	6	17	15	34	25	13	314	0.571	33	Staffing
S2-26	Lack of or poor motivation	12	16	20	17	19	26	313	0.569	34	Directing
S2-3	Unwise delegation of responsibilities	4	24	12	32	25	13	2140	3.891	35	Directing
S2-45	Misuse of planning techniques	1	17	41	8	29	14	309	0.562	36	Planning
S2-25	Communicating the wrong information at the wrong time	6	29	20	9	23	23	303	0.551	37	Planning
S2-31	Lack of long term planning	18	15	20	7	26	24	300	0.545	38	Planning
S2-46	Poor lead time on projects	0	27	28	19	23	13	297	0.540	39	Planning
S2-24	Using wrong medium of communication	3	30	16	31	17	13	288	0.524	40	Directing

Table 4.1 Ranking based on RII (Continued).

Code	Management Factors	Total Score						Weighting	RII	Rank	Remark
		0	1	2	3	4	5				
S2-8	Poorly educated client	6	18	29	29	18	10	285	0.518	41	Staffing
S2-22	Poor timing of communication	4	26	28	22	16	14	282	0.513	42	Planning
S2-23	No detailed communication channel	10	16	22	34	23	5	279	0.507	43	Directing
S2-42	Inappropriate motivation factors	7	15	42	20	13	13	276	0.502	44	Directing
S2-11	Improper monitoring of delegated work	2	30	23	24	28	3	275	0.500	45	Directing
S2-2	Lack of job description	23	21	16	15	26	9	1903	3.460	46	Organising
S2-41	Poor documentation	11	42	15	6	23	13	247	0.449	47	Organising
S2-1	Unclear roles /job description	0	46	12	10	30	4	2914	5.298	48	Organising
S2-9	Lack of day-to-day administration	8	51	12	18	15	6	219	0.398	49	Directing
S2-10	Misplaced information	19	39	9	17	24	2	214	0.389	50	Directing

10 strongest factors (management practices) that affected delays of completion times were identified from Table 4.1 and these are summarised in Table 4.2.

From Table 4.2, it can be concluded that, the management practice with the strongest effect on completion time is poor planning. A further analysis was carried out for confirmation on whether these ten factors really had a strong effect on delay. The method used in carrying out the further analysis was the logistic regression model. This model was to test the significance of the probability of the ten factors having effect on delay or not. The development of model is shown as follows.



Table 4.2 The strongest ten management practices affecting delay.

Code	Management Factors	Remark
S2-27	Poor planning	Planning
S2-20	Inadequate contractor experience	Staffing
S2-37	Long waiting time for approval of drawings by client	Planning
S2-38	Delay in design information, mistakes and discrepancies in design documents	Planning
S2-30	Dealing with unreliable subcontractors and suppliers	Staffing
S2-39	Long waiting time for approval of test samples of materials	Planning
S2-14	Poor site management and supervision	Directing
S2-33	Inability to follow schedule	Controlling
S2-35	Communicating of variations in design at inappropriate time	Planning
S2-29	Work overload	Planning

4.3.1 Module Development

The choice of this model was based on the fact that the desired result, the determinants of the better management practice could be obtained through the analysis where “Y” represents the desired management practice. The actual response variable Y, is a binary variable (outcome, dependent) with possible values of zero and one and represent delay or no delay. That is,

$$Y=\begin{cases} 1 \text{ delay} \\ 0 \text{ no delay} \end{cases}$$

Due to the nature of Y, the response variable, the multiple linear regression model (MLR) although easier to estimate and interpret, could not be used.

4.3.1.1 The Multiple Linear Regression Module (MLR)

Under the MLR model, the relationship between response variable Y and the k predictor variables is studied. The model assumed is

$$Y = \beta_0 + \sum_{j=1}^k \beta_j X_j + \varepsilon$$

Where: Y is the dependent variable

k is the number of independent variables (predictors)

$\beta_0, \beta_1, \dots, \beta_k$ are the model parameters and ε is the error term.

The assumptions made under this module are;

1. $\text{Var}(\varepsilon)$ is independent of Y
2. ε is normally distributed
3. The probability of occurrence of the event Y, lie between zero and one. Thus $0 \leq P(Y) \leq 1$

However, where a binary variable such as that used in this study is analysed using the MLR, these assumptions do not hold.

4.3.1.2 Proof of Violation of assumption.

Assumption 1: The independence of $\text{Var}(\varepsilon)$ on Y;

From the model (1), ε takes values

$$-\left(\beta_0 + \sum_{j=1}^k \beta_1 X_1 + \varepsilon\right) \text{ for } Y=0 \text{ and } 1 - \left(\beta_0 + \sum_{j=1}^k \beta_1 X_1 + \varepsilon\right) \text{ for } Y=1.$$

Y being a binary random variable takes values of only 0 and 1. Hence the probability distribution of ε , $f(\varepsilon)$ is given by:

$$f(\varepsilon) = p^y (1-p)^{1-y} \text{ where } y = 0, 1 \text{ and } p \text{ is the expected value of } y \text{ and } s \text{ given by:}$$

$$P = E(Y)$$

$$= E\left[\beta_0 + \sum_{j=1}^k \beta_1 X_1 + \varepsilon\right]$$

$$= \beta_0 + \sum_{j=1}^k \beta_1 X_1, \text{ since } E(\varepsilon) = 0 \text{ thus}$$

$$P = E(Y) = \beta_0 + \sum_{j=1}^k \beta_1 X_1.$$

Applying 1 and 2 values of $f(\varepsilon)$ given Y has a value of zero is given by:

$$f(\varepsilon) = (1-P) = 1 - \left(\beta_0 + \sum_{j=1}^k \beta_1 X_1\right) \text{ and when } Y \text{ has a value of 1, } f(\varepsilon) \text{ is given as:}$$

$$f(\varepsilon) = P = \left(\beta_0 + \sum_{j=1}^k \beta_1 X_1\right)$$

Table 4.3 Summary of binary variable Y

	ε	$f(\varepsilon)$
$Y=0$	$-\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$	$1 - \left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$
$Y=1$	$1 - \left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$	$\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$

The variance of ε is given by; $\text{var}(\varepsilon) = \sum_{y=0}^1 \varepsilon_y^2 (f(\varepsilon_y))$

$$\text{Var}(\varepsilon) = \left(-\left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right)^2 \left(1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right) + 1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)^2 \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)$$

Which reduces the simple but tedious algebra to;

$$\text{Var}(\varepsilon) = \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right) \left(1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right) \dots\dots\dots 3$$

Hence from 3 we have that:

$$\text{Var}(\varepsilon) = (E(Y)) [1 - E(Y)] \text{ Showing that the variance of } \varepsilon \text{ depends on } Y.$$

Assumption 2: ε is normally distributed since Y takes only the values of 0 and 1.

Assumption 3: The probability of the occurrence of the event Y lies between zero and one, thus $0 \leq P(Y) \leq 1$. The probability of the event Y occurring or not occurring as estimated by the linear probability model could be greater than 1 or less than 0 which is in contradiction of the assumptions that authenticate the use of the model.

Table 4.3 Summary of binary variable Y

	ε	$f(\varepsilon)$
Y=0	$-\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$	$1 - \left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$
Y=1	$1 - \left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$	$\left(\beta_0 + \sum_{j=1}^k \beta_j X_j\right)$

The variance of ε is given by; $\text{var}(\varepsilon) = \sum_{y=0}^1 \varepsilon_y^2 (f(\varepsilon_y))$

$$\text{Var}(\varepsilon) = \left(-\left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right)^2 \left(1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right) + \left(1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right)^2 \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)$$

Which reduces the simple but tedious algebra to;

$$\text{Var}(\varepsilon) = \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right) \left(1 - \left(\beta_0 + \sum_{i=1}^k \beta_i X_i\right)\right) \dots\dots\dots 3$$

Hence from 3 we have that:

$$\text{Var}(\varepsilon) = (E(Y)) [1 - E(Y)] \text{ Showing that the variance of } \varepsilon \text{ depends on } Y.$$

Assumption 2: ε is normally distributed since Y takes only the values of 0 and 1.

Assumption 3: The probability of the occurrence of the event Y lies between zero and one, thus $0 \leq P(Y) \leq 1$. The probability of the event Y occurring or not occurring as estimated by the linear probability model could be greater than 1 or less than 0 which is in contradiction of the assumptions that authenticate the use of the model.

4.3.1.3 The Logit Model

In the logit model the log-odds ratio is expressed as a linear function of the explanatory variables. The model assumed is

$$\text{Log}\left(\frac{P}{1-P}\right) = \beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$$

Where;

P is the probability of the event occurring and

$\text{Log}\left(\frac{P}{1-P}\right)$ is $\therefore$ the log-odds ratio

$\beta_0, \beta_1, \dots, \beta_k$ are the model parameters

ε is the error term.

The logit distribution is an s-shaped distribution function similar to the standard normal distribution. This model ensures the restriction of estimated probabilities to values between 0 and 1 even when binary random variables such as Y are analysed. Under the logit model

$$\text{Log}_e\left(\frac{P}{1-P}\right) = \beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$$

On taking the antilog on both sides we have

$$\left(\frac{P}{1-P}\right) = \beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$$

Now letting $m = \beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$ we have

$$P = \frac{e^m}{1+e^m}$$

Taking the limits of both sides as $m \rightarrow \infty$, we have

$$\begin{aligned}\lim_{m \rightarrow \infty} P &= \lim_{m \rightarrow \infty} \frac{e^m}{1 + e^m} \\ &= \lim_{m \rightarrow \infty} \frac{e^m}{e^m} \\ &= \lim_{m \rightarrow \infty} \frac{1}{e^{-m}} + \frac{e^m}{e^m} \\ &= \lim_{m \rightarrow \infty} \frac{1}{e^{-m} + 1} \\ &= 1\end{aligned}$$

It is clear from the above that with the logit model,

1. When $\beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon = 0$, $P=0.5$
2. when $\beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$ gets really large, P approaches one
3. When $\beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$ gets really small, P approaches zero

4.3.1.4 Interpretation of Logit Coefficients ($\beta_0, \beta_1, \dots, \beta_k$)

$$\text{From } \text{Log}\left(\frac{P}{1-P}\right) = \beta_0 + \sum_{i=1}^k \beta_i X_i + \varepsilon$$

β_0 is a constant term and represents the nominal value of the log-odds ratio. Thus it is the value of the log-odds ratio when $x_1 = x_2 \dots x_k = 0$.

$\beta_1 \dots \beta_k$, represent the rate of change in the log-odds ratios per unit increase in the value of x .

These can be modified to obtain values that represent a rate of change in the log-odds ratio

$\left(\frac{P}{1-P}\right)$ by taking the Log_e inverse of these. Thus $\text{Exp}(\beta_1), \text{Exp}(\beta_2), \dots, \text{Exp}(\beta_k)$ represents the

rate of change in the odds-ratio. That is the ratio of the probability of an event occurring (P) to the probability of event not occurring ($1-P$). This means that:

1. When $\text{Exp}\beta_1 = a$ where $a > 1$, then a unit change in X_1 would make the event "m" times

as likely to occur. Thus if $\text{Exp}\beta_1 = a$, then for one unit change in X_1 , $\left(\frac{P}{1-P}\right) = a$

$$\text{Therefore } P = \frac{a}{1+a}$$

$$\text{And } 1-P = 1 - \frac{a}{1+a}$$

$$\text{Therefore odd ratio} = \frac{\left(\frac{a}{1+a}\right)}{1 - \left(\frac{a}{1+a}\right)}$$

Thus odds ratio above 1 indicate that an increase (that is a unit change in the independent variable X is associated with an increase in the odds that the dependent Y equals 1 in binomial logistic regression). Therefore an odds ratio > 1.0 means increasing the independent variable X increases the odds that the dependent variable Y equals a given value (usually 1) by a factor of the odds ratio (e.g., a factor of 2 might mean the odds increase from 1:1 to 2:1). The larger the difference between the observed odds ratio and 1.0, the stronger the relationship between X and Y .

2. When $\text{Exp}\beta_1 = 1$, then there exist a 50% chance of the event occurring with a one unit change in the independent variable, X_1

$$\left(\frac{P}{1-P}\right) = 1 \text{ which implies } \therefore P=0.5 \text{ for one unit change in } X_1.$$

Thus odds ratio of 1 indicates the two variables are statically independent.

3. When $\text{Exp}\beta_1 < 1$, then one unit change in X_1 leads to an event being less likely to occur.

Thus An odds ratio below 1 indicates a decrease (that is, a unit change in the independent variable X is associated with a decrease in the odds of the dependent Y being 1 in binomial logistic regression). Therefore, an odds ratio < 1.0 signifies the odds the dependent variable Y equals a given value decreased by a factor of the odds ratio (ex., a factor of 2 might mean the odds decrease from 2:1 to 1:1).

4.3.1.5 Hypothesis Testing

This test determines whether the inclusion of a particular independent variable in the model makes a significant difference. This aspect of the analysis is very important especially when it comes to determining the quality of overall model since, in this study the method of selecting independent variables was by ranking using the relative importance index (RII). In this test the hypothesis used is;

$H_0; \beta_1 = 0$, i.e. X_1 has no significant effect on the log-odds ratio

$H_1; \beta_1 \neq 0$, i.e. X_1 has a significant effect on the log-odds ratio.

In this test, the WALD (W) statistic of the β_1 coefficient is used as the test statistic where

$W\left(\frac{\beta}{\text{S.E}\beta}\right) \sim \chi^2$ and $\text{S.E}\beta$ is the standard error of β_1 . From results generated, H_0 is rejected if

$W > C$, where C is the 95th percentile of the chi-square distribution with a degree of freedom of one.

4.3.1.6 Evaluation of Overall Performance of the Model.

In the evaluation of the overall performance of the logistics regression model in this study, the model likelihood ratio test is used.

4.3.1.7 The Model Likelihood Ratio (LR)

The likelihood test is a general large-sample test which is based on the maximum likelihood method. It consist of using $-2\log \alpha$ which has a chi-square distribution with “r” degrees of freedom. Where “r” represent the number of independent variables and

$$\alpha = \frac{\max(L(\beta))_{\text{under restriction}}}{\max(L(\beta))_{\text{without restriction}}}$$

$LR(r) = [-2 \times \text{initial LL}] - [-2 \times \text{ending LL}]$. The initial LL refers to the log likelihood of the model without restrictions.

4.3.1.8 The Overall Logistic Regression Model

The logistic regression model was built on the dependent variable delays which hold values one (1) for delays and zero (0) for no delays and the independent variables;

		<u>Code</u>
1	Poor planning	S2-27
2	Inadequate contractor experience	S2-20
3	Long waiting time for approval of drawings by client	S2-37

4	Delay in design information, mistakes and discrepancies in design documents	S2-38
5	Dealing with unreliable subcontractors and suppliers	S2-30
6	Long waiting time for approval of text samples of materials	S2-39
7	Poor site management and supervision	S2-14
8	Inability to follow schedule	S2-33
9	Communicating of variations in design at inappropriate time	S2-35
10	Work overload	S2-29

The model is presented in Tables 4.4 to 4.12 in an SPSS output as shown below.

4.3.2 Logistic Regression Model

Table 4.4 Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	110	100.0
	Missing Cases	0	.0
	Total	110	100.0
Unselected Cases		0	.0
Total		110	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 4.5 Dependent Variable Encoding

Original Value	Internal Value
0	0
1	1

Block 0: Beginning Block

Table 4.6 Classification Table

Observed			Predicted		
			Delay		Percentage Correct
			0	1	
Step 0	Delay	0	0	12	.0
		1	0	98	100.0
Overall Percentage					89.1

- a. Constant is included in the model.
- b. The cut value is .500

Table 4.7 Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 Constant	2.100	.306	47.150	1	.000	8.167

Table 4.8 Variables not in the Equation

Step	Variables	Score	df	Sig.
0	S2_20	1.339	1	.247
	S2_27	2.905	1	.088
	S2_37	.000	1	.996
	S2_38	.341	1	.559
	S2_30	.893	1	.345
	S2_39	.184	1	.668
	S2_14	1.595	1	.207
	S2_33	.034	1	.854
	S2_35	.049	1	.824
	S2_29	.255	1	.613
Overall Statistics		16.510	10	.086

Block 1: Method = Enter

Table 4.9 Omnibus Test of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	19.650	10	.033
	Block	19.650	10	.033
	Model	19.650	10	.033

Table 4.10 Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	56.165	.164	.328

Table 4.11 Classification Table

Observed			Predicted		Percentage Correct
			Delay		
			0	1	
Step 1	Delay	0	2	10	16.7
		1	1	97	99.0
Overall Percentage					90.0

a. The cut value is .500

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Table 4.12 Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	S2_20	-1.553	.687	5.112	1	.024	.212
	S2_27	-1.318	.681	3.751	1	.053	.268
	S2_37	.929	.530	3.074	1	.080	2.532
	S2_38	-.125	.421	.088	1	.767	.883
	S2_30	-.187	.394	.226	1	.635	.829
	S2_39	.630	.337	3.494	1	.062	1.878
	S2_14	1.346	.482	7.797	1	.005	3.841
	S2_33	-.385	.479	.645	1	.422	.680
	S2_35	-.174	.474	.136	1	.713	.840
	S2_29	.095	.472	.041	1	.840	1.100
	Constant	6.451	2.460	6.877	1	.009	633.246

a. Variable(s) entered on step 1: S2_20, S2_27, S2_37, S2_38, S2_30, S2_39, S2_14, S2_33, S2_35, S2_29.

4.3.3. Interpretation of the Model

The main interpretation of the model is based on Table 4.12, since it gets into the heart of the results. It shows the coefficient (B), the standard error (SE), the Wald chi-square statistic (Wald),

the associated P-value (Sig) and the odds ratio (Exp (B)). Interpreting using the coefficient can be awkward. E.g. for a unit increase in poor site management and supervision (S2_14), the log odds of it affecting delay (vs. not affecting delay) increase by 1.346. Therefore the odds ratio will be preferred in interpreting the results. As earlier explained, an odds ratio greater than one suggest a positive relationship, and the larger the difference between the observed odds ratio and one, the stronger the relationship. Hence, from Table 4.12, it can be seen that S2_37 (Long waiting time for approval of drawings by client), S2_39 (Long waiting time for approval of text samples of materials), S2_14 (poor site management and supervision) and S2_29 (work overload) are the only practices with positive effects on delay. However, only S2_14 (poor site management and supervision) is significant at the 95th percentile. Although S2_20 (Inadequate contractor experience) is significant, it does not have a positive effect on delay. That is, holding all other variables constant, one unit change in inadequate contractor experience, the odds of it affecting delay (vs. not affecting delay) is decreased by a factor of 0.21. Interpreting S2_14 which has the highest and significant odds ratio(Exp (B)), we can say, holding all other variables constant, one unit increase in poor site management and supervision, will cause the odds of it affecting delay(vs. not affecting delay) to increase by a factor of 3.84. In summary, the model only finds poor site management and supervision as the most significant management practice that affect completion period of building projects.

4.3.4 Significance of the Model

The likelihood ratio chi-square of 19.65 with a p-value of 0.03 from Table 4.9 tells us that our model as a whole fits significantly better than the empty model (Model 0). The -2 log likelihood was used to compare the fit of this model with model 0. The value of the model likelihood ratio

(LR) which was the statistic used to test the performance of the overall regression model was 56.16 (Table 4.10). The LR with a degree of freedom of 10 (the number of independent variables), at a significance of 0.05 lead to the conclusion that the overall model was statistically significant. The value obtained from the statistical Tables (the critical value) was 1.81

As earlier stated, the decision rule to reject $H_0: \beta_1 = 0$, (i.e. X_1 has no significant effect on the log-odds ratio) and accept $H_1: \beta_1 \neq 0$, (i.e. X_1 has a significant effect on the log-odds ratio), is $W(\text{wald test statistic}) > C(\text{critical value})$. The critical value (C) read from statistical Table (chi-square Table) $\chi^2_{0.05}$ is 3.84. Therefore, reading from Table 4.12, H_0 is rejected for only S2_20 (Inadequate contractor experience) and S2_14 (poor site management and supervision) whilst for the others H_0 is accepted at the 95th percentile.

4.4 PLANNING AS THE MANAGEMENT FUNCTION WITH MOST EFFECT ON

DELAY

To find out if planning is the management function with most effect on delay can be deduced from the management practices that affected delay the most. From Table 4.13, it can be seen that, out of the ten most important factors that were identified from the RII ranking, six were planning factors implying that, planning is the predominant management function in the first ten management practices that affect delay. One may argue that since the grouping of the practices into functions was subjective, this assumption may not hold, but Table 4.13, shows that, although the assignment of the management functions was subjective the fraction of its occurrence in the first ten makes this assumption hold. For example, although controlling has only four practices under it, just one appearance in the first ten gives it a quarter fraction of its occurrence in the first

ten. Therefore, the planning function having the highest fraction of occurrence of 0.43 in the first ten confirms it as being the predominant function.

Table 4.13 Distribution of management practices in functions

Management Function	Total Distribution	Distribution in first ten	Percentage of distribution in first ten	Fraction of occurrence in first ten
Planning	14	6	60	0.43
Staffing	7	2	20	0.29
Directing	13	1	10	0.08
Controlling	4	1	10	0.25
Directing	12	0	0	0
Total	50	10	100	-

Again from the model, it was identified that the only factors that had positive effect on delays were; long waiting time for approval of drawings by clients, long waiting time for approval of test samples of materials, poor site management and supervision and work overload. Of these four only poor site management is not a planning function. Therefore, having three out of the only four practices (having positive effect on delay) being planning functions confirms the assumption that planning is the management function that affects project completion time the most. This assumption therefore, proves the first hypothesis for this study, (i.e. Hypothesis 1: Planning is the management function that affects project completion times the most). Although

this has been proven to be true from the RII ranking (used to determine the strongest factors), it is however noted that these factors are not significant at an alpha level of 0.05.

4.5 DIFFERENCES IN RESPONSES BY THE THREE MAIN PARTIES

The questionnaires were responded to by the three main parties involved in a building project namely the client, consultant and the contractor. Since these three parties answered the same sections of the questionnaire (Section 1 and 2) it was therefore necessary to find out whether or not they differed in their response. To carry out this analysis, the SPSS was used to form a cross tabulation of management functions against the three parties. Thus, each of the management practices placed one function and then cross tabulated against the three parties. The SPSS output for the cross tabulation is shown in appendix B (represented by Tables B1 to B5). The frequencies were based on responses and there were 110 valid cases.

Since the study is concerned with identifying strongest factors, only rankings 4 and 5 from the section two of the questionnaires coded strong and very strong were the ones chosen for further analysis. The frequencies presented in the cross tabulation for the two rankings were added (Table 4.14 to Table 4.18) and distributed over their total and then ranked as shown in Tables 4.19 and 4.20.

Table 4.14 Total of Organising frequencies of ranking 4 and 5(coded Strong and Very strong respectively)

Factors	Parties		
	Client	Consultant	Contractor
Strong and Very strong	182	278	170
Total	384	492	444

Table 4.15 Total of Directing frequencies of ranking 4 and 5(coded Strong and Very strong respectively)

Factors	Parties		
	Client	Consultant	Contractor
Strong and Very strong	144	210	156
Total	384	492	444

Table 4.16 Total of Planning frequencies of ranking 4 and 5(coded Strong and Very strong respectively)

Factors	Parties		
	Client	Consultant	Contractor
Strong and Very strong	207	343	306
Total	448	574	518

Table 4.17 Total of Controlling frequencies of ranking 4 and 5(coded Strong and Very strong respectively)

Factors	Parties		
	Client	Consultant	Contractor
Strong and Very strong	63	91	97
Total	128	164	148

Table 4.18 Total of Staffing frequencies of ranking 4 and 5(coded Strong and Very strong respectively)

Factors	Parties		
	Client	Consultant	Contractor
Strong and Very strong	108	122	131
Total	224	287	259

Table 4.19 Distribution of the strong and very strong factors over the total

	Client	Consultant	Contractor
Organising	13.79	21.06	12.88
Directing	10.91	15.91	11.82
Planning	13.44	22.27	19.87
Controlling	14.32	20.68	22.05
Staffing	14.03	15.84	17.01

Table 4.20 Ranking using the distributed frequencies of the strongest management functions affecting delay

	Client	Consultant	Contractor
Organising	3	2	4
Directing	5	4	5
Planning	4	1	2
Controlling	1	3	1
Staffing	2	5	3

It can be seen from Table 4.20 that, the rankings given by the three parties differed, whilst the client had control followed by staffing to be the strongest functions, the consultant had planning followed by organising and the contractor had control followed by planning as the strongest management functions affecting completion time. These assertions have a bearing on the second hypothesis of this study (i.e. Hypothesis 2: Clients, consultants and contractors differ in the management functions they perceive as the strongest).

Proof: Since the ranking shown in Table 4.20 showed that all the three parties have a different view of the functions they perceive as the strongest, it is an indication that this hypothesis is correct.

4.6 OTHER RELATED ISSUES

This aspect of the analysis discusses other issues aside determination of strongest factors. It comprise descriptive analysis (using frequencies and percentages and charts) discussing more on the management practices. The discussion is grouped under the five main management functions.

The analysis was mostly done using responses of only those who responded to the questions and excluding non applicable responses. It puts together the responses of all the three parties except questions that were directed to specific parties.

4.6.1 Planning

Table 4.21 is a table showing respondents usage of planning techniques against its ability to determine critical activities. From the Table 4.21, 66 representing majority of respondents (84.62%) clearly stated that, they use the bar chart technique for planning. Surprisingly, 40 out of the 66 also responded that the bar chart determines critical activities. However, among the options given respondents, only the network diagram could determine critical activities and only 11.54% of respondents were using it. This therefore, means that most of the respondents to this question who were contractors and consultants had little knowledge about the functions of the techniques and critical activities.

Table 4.21 Planning technique against ability to determine critical activity

Planning technique used	Ability to determine critical activities			
	Yes	No	Total	Percentage
Bar chart	40	26	66	84.62
Network diagram	8	1	9	11.54
Line of balance	3	0	3	3.85
Total	51	27	78	100.00

With particular reference to how the client's planning activities affect time, Fig 4.3 shows that 66.67% responded that they encounter situations where decisions regarding changes in design by the client were made at a time that works already completed had to be changed/varied. This practice has so much effect on time since the changed/varied works requiring re-construction has not been captured in the works programme. Further implication of this is that, most clients are not aware and hence do not plan when to communicate variations in design. Sometimes, the natures of the changes are such that, works has to be put on hold till instructions are received and works executed. This assertion was verified by majority of contractors representing 97.37% (Fig 4.4) who have experienced it at least once on a project. If any of the activities put on hold are critical activities, then it causes a delay. Again, 78.13% (Fig 4.5) of clients added that the decision making period of the client had affected the progress of projects.

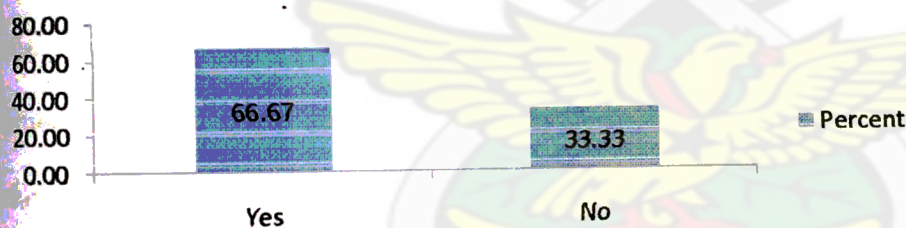


Fig 4.3 Major decisions arising to redo of completed works

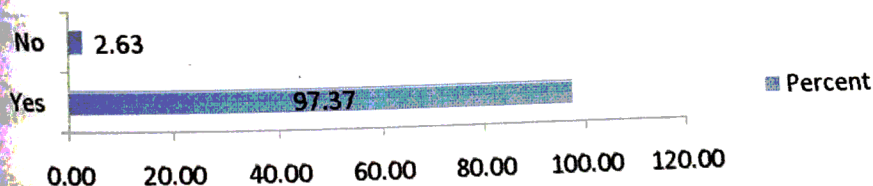


Fig 4.4 Encountering of situation where works are put on hold awaiting changes in design

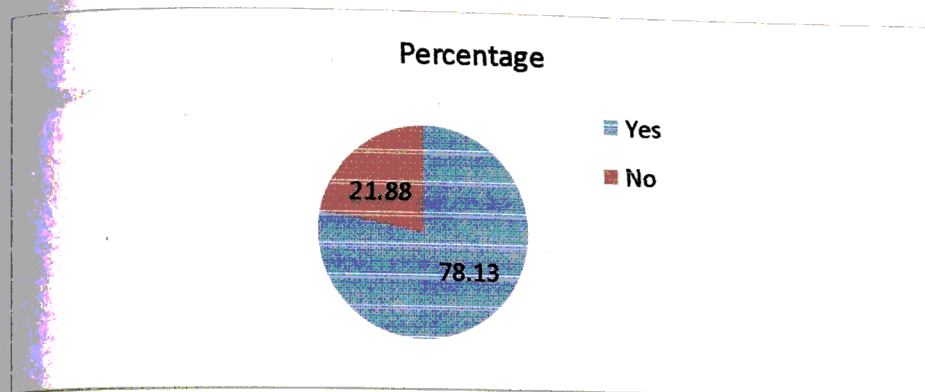


Fig 4.5- Decision making period affecting progress of project

4.6.2 Directing

The statistics shown in Table 4.22 indicates that contractors and consultants give proper attention to motivation of workers. From Table 4.22, out of 49 (representing 62.82% of respondents) who motivate their workers throughout the project, 45 of them aimed it towards controlling project time. Review of literature indicated that if workers are motivated, they give off their best and sometimes when some activities are delayed, motivation can be used to bring the project on schedule (Mullins 2002).

Table 4.22 Period of motivation against aiming motivation at project control

Period of motivation	Aiming motivation at controlling projects			
	Yes	No	Total	Percentage
When delay is eminent	28	1	29	37.18
Throughout the project	45	4	49	62.82
Total	73	5	78	100.00

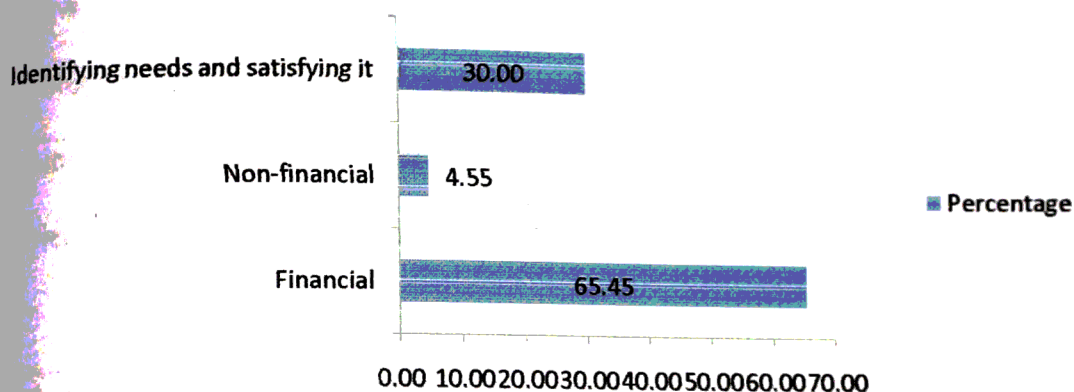


Fig 4.6 Forms of motivation

Fig 4.6 however shows that only 30% of motivation is carried out by a factor such as identifying needs and satisfying it, whilst 65% use financial motivation factors. Both Maylor and Harris (2000, 2005) identified that the best motivation factor is identifying needs and satisfying them. Therefore in our case there is the probability that the best results from motivation may not be achieved.

Table 4.23 Having communication barriers against having lines of communication clearly stated on each project

Having communication barriers	Lines of communication clearly stated on each project			
	Yes	No	Total	Percentage
Yes	12	20	32	29.09
No	39	39	78	70.91
Total	51	59	110	100.00

Table 4.24 Having communication barriers against unclear lines of communication clearly affecting the performance of an activity on a project

Having communication barriers	Unclear lines of communication ever affecting the performance of an activity on a project			
	Yes	No	Total	Percentage
Yes	28	4	32	29.09
No	60	18	78	70.91
Total	88	22	110	100.00

On communication, 78 out of all the respondents (representing 70.91%) said they do not have communication barriers. However 39 out of this 78 said they do not have the lines of communication clearly stated on each project(Table 4.23) and 60 out of the 78 also indicated that unclear lines of communication has ever affected the performance of an activity (Table 4.24). These contradicting statistics indicate that, although respondents admit not having communication barriers, it is really a problem facing them. This was further highlighted by Sharma (2001) who explained that, clear communication lines enhance coordination and control without which delay is eminent.

4.6.3 Organising

On coordination, as earlier on identified in the review of literature, project success depends largely on coordination and cooperation (Phud and Rowlinson, 2004). Since most of the parties involved in a project have their individual firms, there is always a conflict on where to commit, either to the project or to the firm. If commitment is more geared to the firm, it affects the

success of the project and vice versa. Statistics from Table 4.25 shows harmony in responses such that 81 (73.64%) out of 110 of all respondents are more committed to project objectives on a project, therefore, it is not surprising that 60 out of the 81 direct coordinating activities first to project goals before company goals, which also contribute to the success of the project.

Table 4.25 Commitment of objection against gearing of coordination

Attention to commitment on a project	Gearing of coordination			
	Project goals first followed by company goals	Company goals first followed by project goals	Total	Percentage
Commitment to project objectives	60	21	81	73.64
Commitment to company objectives	13	16	29	26.36
Total	73	37	110	100.00

Responding on the various ways of enhancing coordination, Fig. 4.7 below shows the major ways respondents used to enhance coordination. Majority prefer holding people to task and motivation as the best means of enhancing coordination.

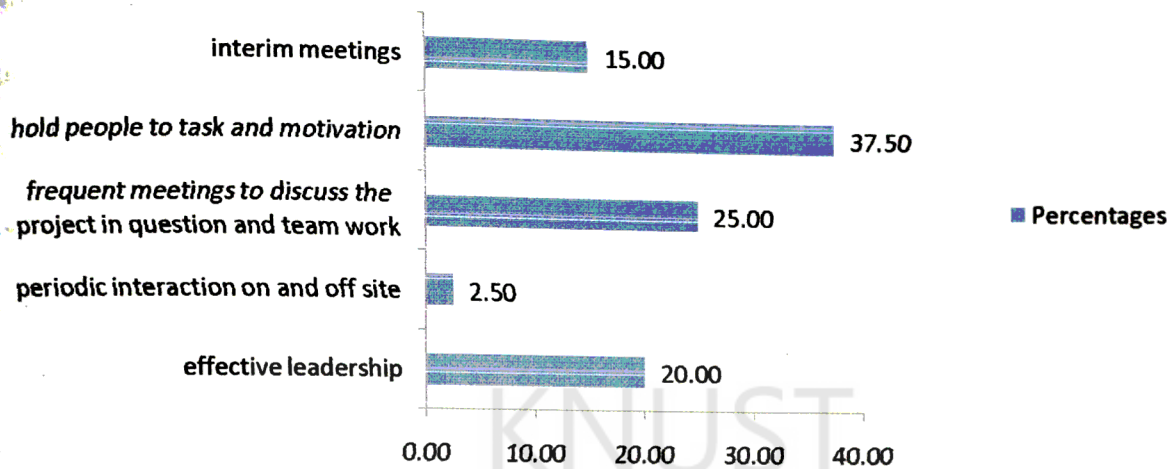


Fig. 4.7 Major ways of enhancing coordination on a project

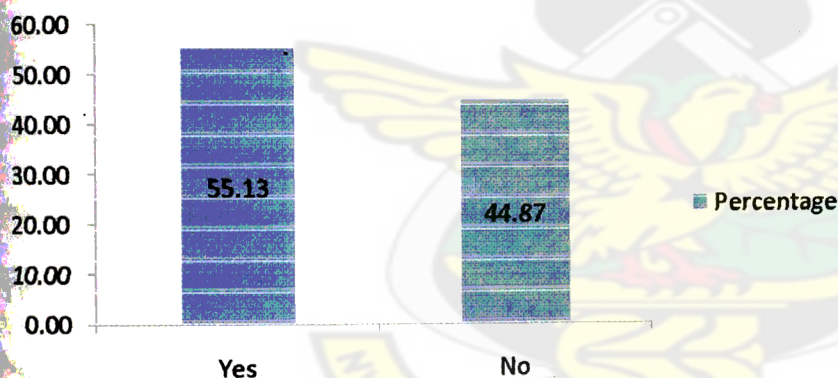


Fig 4.8 Having an organisational chart for every project

Fig 4.8 shows that 44.87% respondents (contractors and consultants) do not have an organisational structure for every project. Although 55.13% of them have, having 44.87% who do not have can mean that things are not done orderly on project. The absence of the organisation chart can also mean that lines of communication and roles and relationships are not indicated on

the project, making communication, control and coordination difficult. However an outstanding performance was indicated by contractors as shown in Table 4.26. Out of the 31 contractors, who had organisational chart for the management of the site, (representing 83.78%) 21 had their charts reflecting both roles and responsibilities and channels of reporting. Also 65.85% (Fig 4.9) of consultants showed they have an organisation structure showing roles, responsibilities, relations and channels of communication for the arrangement of things within the consultancy team. The above statistics indicates an orderly arrangement on the site and within the consultancy team for the execution of building projects.

Table 4.26 Having an organisational chart for the management of site against the reflection of the organisational chart.

Having organisational structure for management of site	Reflection of organisational structure				
	Roles and responsibilities	Channels of reporting	Both	Total	Percentage
Yes	6	4	21	31	83.78
No	6	0	0	6	16.22
Total	12	4	21	37	100.00

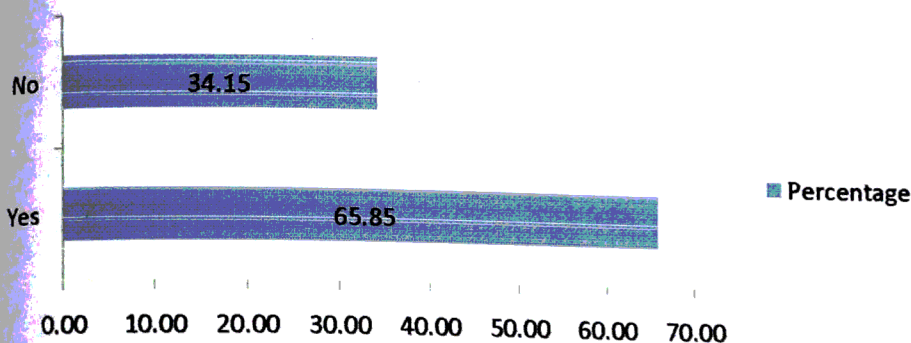


Fig 4.9 Consultants having an organisational structure indicating roles, responsibilities and communicating channels for the consultancy team

4.6.4 Staffing

Projects are realised through a group of people, therefore, it makes the staffing function an essential function for the success of every project. Hence, any defect in it can affect the project time which is also part of successful project (Ashworth and Hogg, 2001). On the issue of selecting contractors for project, 72.60% (Fig 4.10) of clients and consultants said they consider their previous work, profile and recommendation from others. This high percentage indicates that they put in much effort in order not to select an incapable contractor, compared to only a few who considered only one of the things the majority considered.

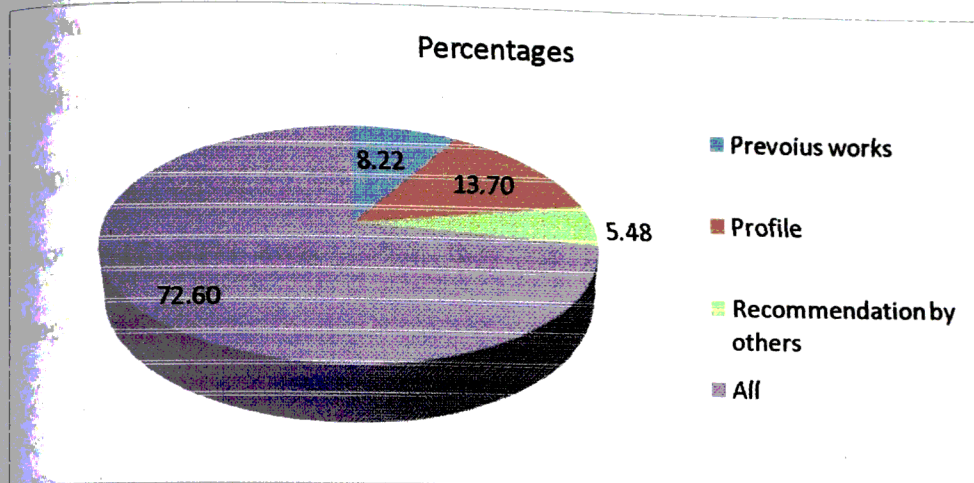


Fig 4.10 Basis for determining contractor and supplier experience

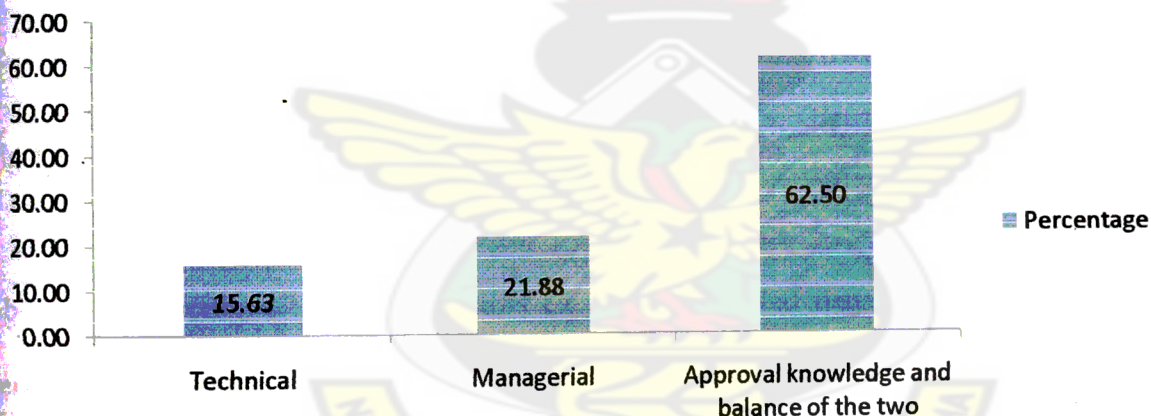


Fig 4.11- Prioritisation of the skills of the project manager

From Fig 4.11, majority of clients representing 62.5% also indicated that when choosing a project manager to handle a project they considered a balance in both his technical and managerial skills. Although this percentage is encouraging, having 21.88% and 15.63% indicating they considered either his managerial or technical skills alone respectively represent a

loop in the industry. This is because all the major management aspects of the project including coordination and ensuring a smooth running of the project without hitches with timely completion is done by the project manager. Therefore, even though these figures indicate the minority (21.88% and 15.63%), they are relatively too high to ensure successful timely completion.



Fig 4.12 Majority forming labour force of artisans

About 81.08% (Fig 4.12) of contractors also responded that majority of their workforce are permanent workers. This is a positive sign since a lot of their workers may be motivated by job security and therefore would give their best and not idle about to cause delay. Responses from the survey also indicated that personnel in a firm are assigned to a lot of projects. From Fig 4.13, majority of personnel are assigned to more than six projects. This creates a conflict of interest since the personnel cannot have enough time for each of the project. This creates a situation where personnel are unable to meet deadlines and give their best. This shows a setback in the industry and therefore need to be addressed.

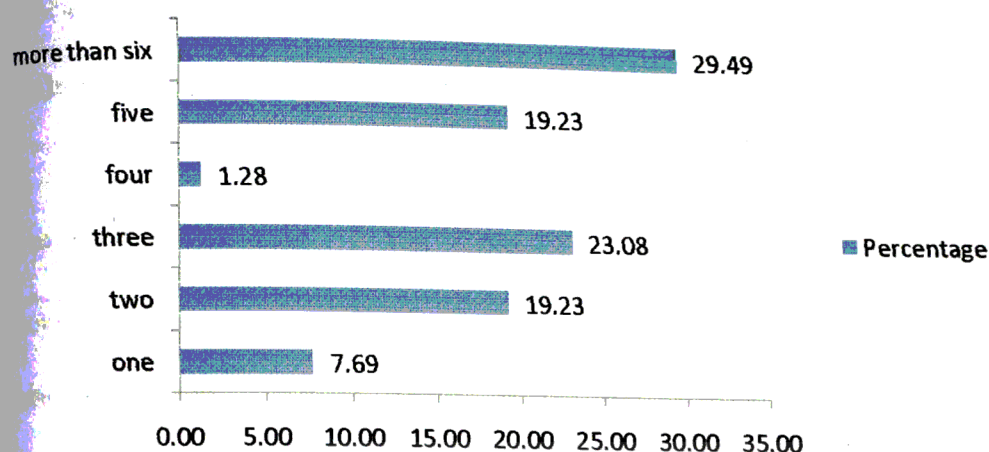


Fig 4.13 Maximum number of projects to which personnel are assigned to in a firm.

4.6.5. Controlling

Table 4.25 also shows a similar response to Table 4.21. The responses (from contractors and consultants) are again contradictory with regard to majority indicating that they use the bar chart programming method for controlling their projects and at the same time indicating that the bar chart programming method shows critical activities. Another interesting point identified in Table 4.25 from respondents is that, only 2 (representing 5.41%) respondents used the PERT programming method and all the two indicated that the method cannot detect critical activities. The issue of choosing a programming technique for controlling project is essential since the technique chosen should be able to show critical activities, linkages and float so that crucial decisions on which activity to control and by how much can easily be identified. Therefore, the statistics shown in Table 4.25 are not encouraging for the Ghanaian construction industry especially when little is known about PERT.

Table 4.27 Planning technique for controlling projects against ability to determine critical activities

Planning technique used	Ability to determine critical activities			
	Yes	No	Total	Percentage
Bar chart	12	4	16	43.24
Network diagram	14	5	19	51.35
PERT	0	2	2	5.41
Total	26	11	37	100.00

With regard to measuring progress against programme and determining delays, 89.09% (Fig 4.14) and 85.32% (Fig 4.15) respectively of respondents indicated that they compare the works programme to the actual progress of the works to determine delays and also to measure progress. Among the various responses given on this issue were physical development, visual observation, financial and physical, time stage graph. Majority of respondents, however, indicted they use a comparison of the works programme and the actual progress on site. This method has been identified by Kerzner (2003) to be a better one.

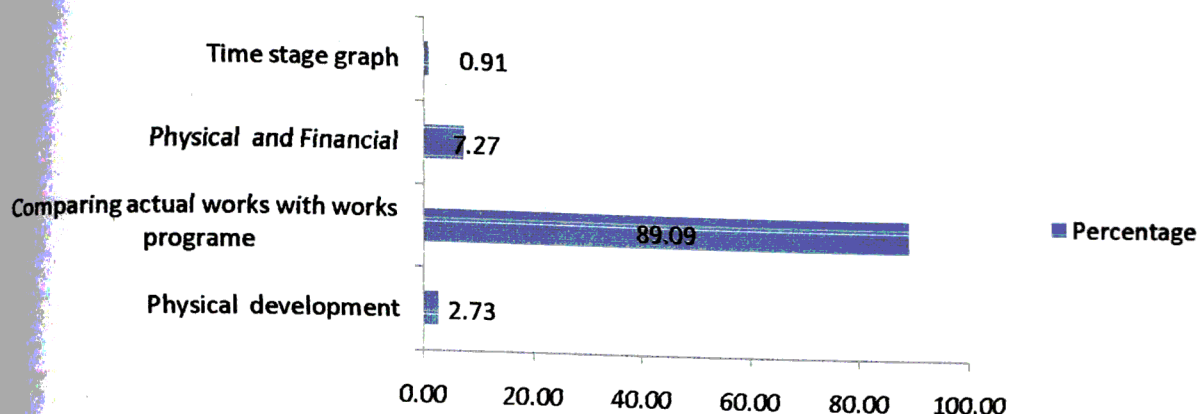


Fig 4.14 Major ways of measuring progress

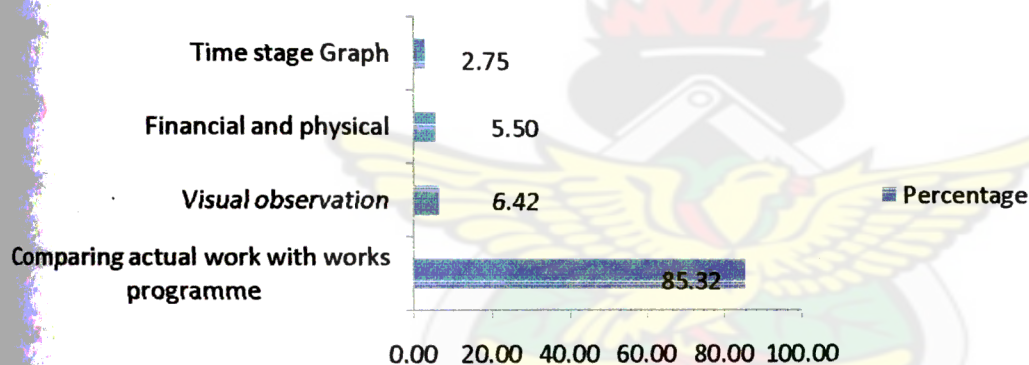


Fig 4.15 Major ways of determining delays

Further responses on the measures used to control projects also had majority of them using a reconciliation of the works programme and actual works (97.37% from Fig 4.16). This response is therefore not surprising.

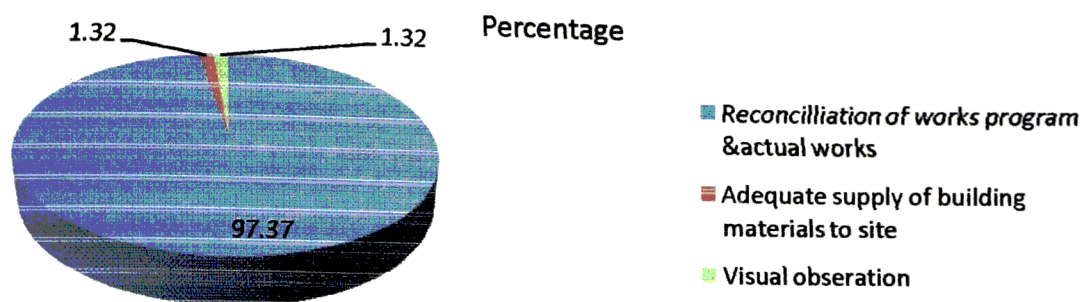


Fig 4.16 Major control measures for monitoring and controlling projects.

A disturbing response was when contractors were asked how best they manage delays when the cause was no fault of theirs. From Fig 4.17, majority of them representing 72.97% replied they apply for extension of time, whilst only 10.81% replied they put in measures which enable them complete on schedule and 16.22% replied they do both. These responses mean that many a time, when contractors are not the cause of delays, they are not concerned about adoption of measures to complete the project on time. Their only interest lies in the application for an extension of time.

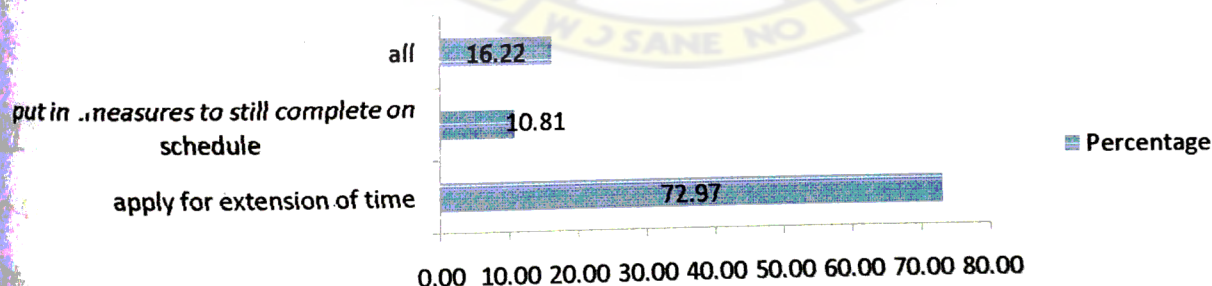


Fig 4.17 Ways contractors use to manage delays when delays are caused by other parties

Fig 4.18 also shows that contractors (97.30%) expressed concern about how the activities of nominated sub-contractors and suppliers affect their progress on site. Therefore, adequate investigation on compatibility with the main contractor is required when selecting nominated sub-contractors and suppliers to ensure effective cooperation by both to attain timely completion of projects.

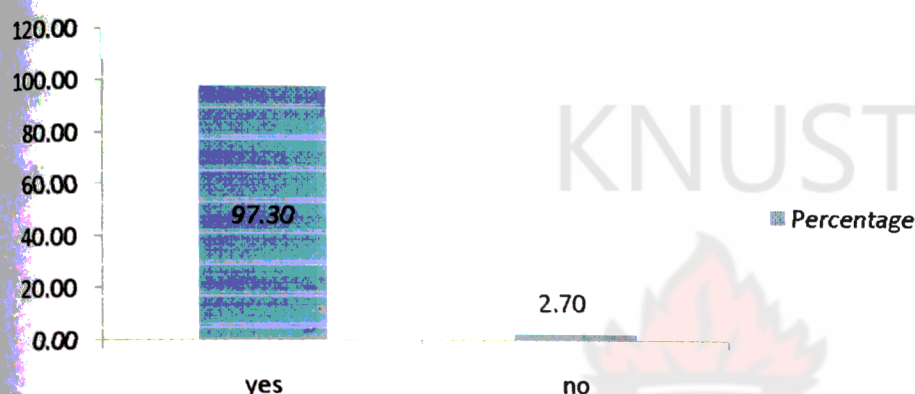


Fig 4.18 Performance of nominated sub-contractors and suppliers activities affecting progress of main contractor.

These descriptive analysis indicate that if planning, staffing, directing, organising and controlling are not carried out with adequate concern, they can affect completion time of building projects and the overall success of the construction industry as well.

4.7 COMPARISON WITH OTHER WORKS

In Ghana, most research works on completion time have been directed towards general factors affecting completion time. This research, however, only considered management factors. Extracting management factors from a research work carried out by Oppong (2003) on causes of delay in Ghana, he identified poor site management and supervision followed by inadequate

contractor experience as strongest factors causing delays. This study also had the two identified by Oppong (2003) to be among the ten strongest management factors affecting delay. On the other hand, this study had inadequate contractor experience as the 2nd strongest factor and poor management of site supervision as the 7th strongest factor, however according to the logit model, poor site management and supervision had a greatest effect of on delay. This is not surprising because these studies were carried out at different time frames. Other studies carried out in other countries had the following as management factors affecting delay which was also identified by this study.

Researchers

Management practices Identified

Frimpong et al. (2003)	Poor contract management
Chan and Kumaraswamy (1998)	Poor site management and supervision, low speed of decision making involving all project teams, client initiated variations, necessary variations of works and inadequate contractor experience.
Mezher and Tawai (1998)	Changes in design and availability of drawings.
Elinwa and Joshua (2001)	Improper planning and underestimating of project duration.
Nahapiet and Nahapiet in 1985	Client experience and decisiveness and good working relation between main parties.
Nick G. et al (2004)	Client indecisiveness and non-uniformity
Ahmad et al, 2006	Disruptions in communication of information and poor timely communication of information

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The study aimed at identifying management practices and determining which of them had strong effect on completion time of building project (i.e. contributing to delays). Fifty management practices were identified from literature. After this, questionnaires were sent to a sampled number of contractors, consultants and clients for an identification of the ones that were most likely to cause delay and also for information on how they applied some of the management practices. Findings from the analysis of responses (supported with available literature) derived from the survey led to the drawing of conclusions. Out of these conclusions, recommendations were made to help minimise delays arising as a result of bad management practices. Additionally, further research work arising from this study was proposed. This final chapter therefore considers the conclusions drawn, recommendations made and further research proposed from this study.

5.2 CONCLUSION

From the findings generated from this study, the major conclusions drawn were as follows;

- The strongest management factors that have effect on completion time as perceived by clients, consultants and contractors together are:
 1. Poor planning
 2. Inadequate contractor experience

3. Long waiting time for approval of drawings by client
 4. Delay in design information, mistakes and discrepancies in design
 5. Dealing with unreliable subcontractors and suppliers
 6. Long waiting time for approval of text sample of materials
 7. Poor site management and supervision
 8. Inability to follow schedule
 9. Communicating of variations in design at inappropriate time
 10. Work overload
- There is a variation on how clients, consultants and contractors rank management functions with respect to how they affect completion time. The variations are:

<u>Functions</u>	<u>Client</u>	<u>Consultants</u>	<u>Contractors</u>
Organising	3	2	4
Directing	5	4	5
Planning	4	1	2
Controlling	1	3	1
Staffing	2	5	3

- Planning and controlling activities have strong effect on completion time.
- Management practices have effect on completion time in Ghana
- The most used planning technique is the bar chart and most contractors have little ideas about the Programme/Project and Evaluation Review Technique (PERT).

5.3 RECOMMENDATIONS

From the conclusions, made the following recommendations have been made for consideration as means of minimising delays:

- Seminars should be organised at the commencement of every project to highlight the organisation of the project and participants trained in the various planning techniques to be used on each project.
- Orientations should be held for clients to make them aware at the onset of projects of the need to plan when to communicate changes in design and also have a short decision time.
- There is also the need for clients and consultants to work well on the brief given by the client during the pre-contract stage of the process so as to minimise variations.
- Personnel working on a project should not be assigned to other projects so as to increase their commitment to project.
- Contractors should be made to employ the right professionals in their companies and this should be made a necessary criterion for class registration under the Ministry of Works and Housing.

5.4 FURTHER RESEARCH

Further research works that can be taken up arising from this study are as follows:

- A study to correlate all the five main management functions to delay, i.e. a multi regression of delay(Y) on management functions(X)
- A study to critically investigate how each of the strongest management practices actually affects completion time.

- A study to further identify more management practices on project basis.

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APPENDIX A

QUESTIONNAIRES

EFFECTS OF MANAGERIAL PRACTICES ON THE COMPLETION TIME OF BUILDING PROJECTS.

This questionnaire is prepared by a final year Msc. Construction Management student to solicit information for the writing of thesis for the award of the Master of Science Degree from Kwame Nkrumah University of Science and Technology.

Your total anonymity is assured, so please feel free to express your views.

Tick (✓) the appropriate response to the following questions to express your views and write responses where necessary.

The targeted area for the questionnaire is the construction industry.

Thank you for answering this questionnaire.

SECTION 1

A. Which of these areas of construction are you involved in?

Client ii. Consultant iii. Contractor

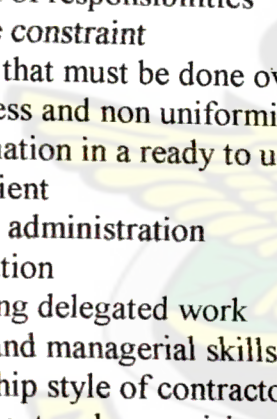
B. Have you encountered delays on some projects?

i. Yes ii. No

C. How was it managed?

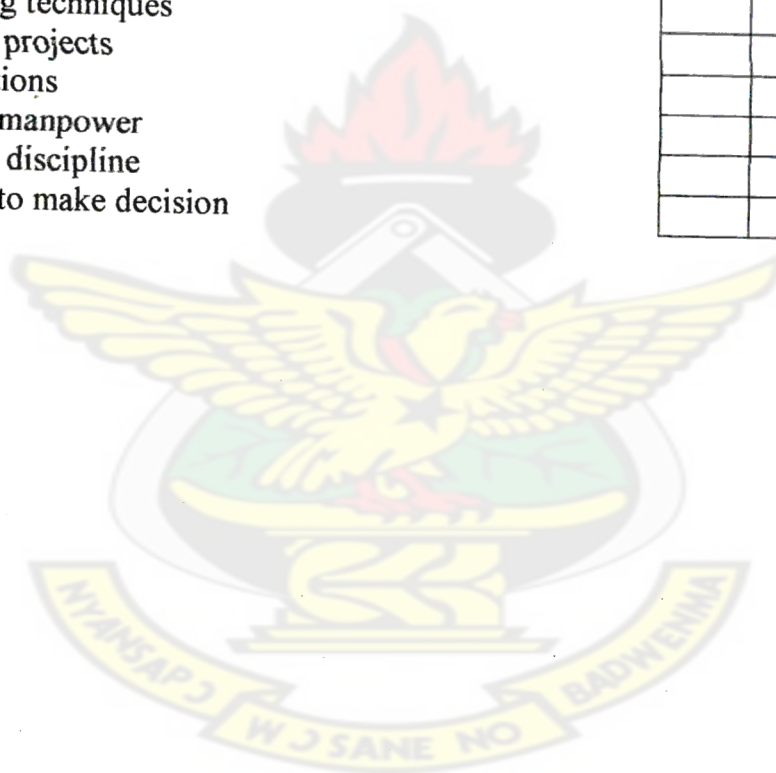
SECTION 2

Rank the following in order of the strongest factors affecting delays. Starting from 5 being the strongest and the weakest, with 0 being non-applicable.

- 
1. Unclear roles/job description
 2. Lack of job description
 3. Unwise delegation of responsibilities
 4. Unreasonable time constraint
 5. A job poorly done that must be done over
 6. Client indecisiveness and non uniformity
 7. Lack of job information in a ready to use format
 8. Poorly educated client
 9. Lack of day to day administration
 10. Misplaced information
 11. Improper monitoring delegated work
 12. Lack of technical and managerial skills of the project manager
 13. Unsuitable leadership style of contractor/ project manager
 14. Poor site management and supervision
 15. Poor organizational structure
 16. Non establishment of standards of performance
 17. Poor coordination between design team
 18. Poor coordination of the project manager for the whole project
 19. Poor cooperation
 20. Inadequate contractor experience
 21. Improper detailing
 22. Poor timing of communication
 23. No detailed communication channel
 24. Using a wrong medium of communication
 25. Communicating the wrong information at the wrong time
 26. Lack or poor motivation
 27. Poor planning
 28. Too many people involved in minor decision making
 29. Work overload
 30. Dealing with unreliable subcontractors and supplier

[illegible]

- res
explanation

[illegible]

SECTION 3- Contractor

1. What planning technique do you normally use to plan your projects?
i. Bar chart ii. Network diagram iii. Line of balance iv. Pert
2. Is your planning technique able to detect critical activities?
i. Yes ii. No
3. Does your company plans reflect project plans?
i. Yes ii. No
4. What planning technique do you use in preparing master works programme presented to the project manager?
i. Bar charts, ii. Network diagrams iii. PERT iv. Other, please state.....
5. How are the plans used in monitoring and controlling projects presented?
i. Bar charts, ii. Network diagrams iii. PERT iv. Other, please state.....
6. Is the plan used for monitoring and controlling able to detect critical activities?
i. Yes ii. No
7. On the site, which of these plans is usually used?
i. Monthly ii. Weekly iii. Daily iv. Master program v. all
8. In the case of variations which of these plans do you adjust?
i. Monthly ii. Weekly iii. Daily iv. Master program v. all
9. In cases where delay is eminent which activities do you target?
i. All activities ii. Delayed activities iii. Critical activities
10. Does the planning technique used for controlling projects able to determine total floats?
a. Yes b. No
11. When do you carry out most of the planning activities for a project with regards to what is to be done and when to do it?
a. Pre-contract stage b. Post-contract stage
12. Do you have an organizational structure for every project?
i. Yes ii. No
13. Do you have an organizational structure for the management of sites?
i. Yes ii. No
14. Which of these does the organizational structure reflect?
i. Roles and responsibilities ii. Channels of reporting iii. Both iv Other, please state.....
15. Have you ever encountered a situation whereby major decisions regarding changes in design were made at a time that works already completed had to be removed?

i. Yes ii. No

16. Have you encountered a situation where works are put on hold awaiting changes or instruction in design?

i. Yes ii. No

17. What is the maximum number of projects to which each personnel is assigned to in your firm?

i. 1 ii. 2 iii. 3 iv. 4 v. 5 vi. 6 vii. More than 6

18. Have you ever rejected a contact before?

i. Yes ii. No

19. If answer to 18 is yes what was the reason?

i. Current work load ii. Cannot work with other project party members
iii. Both iv. Other, please state.....

20. How do you avoid work overload?
.....
.....
.....

21. In coordinating activities towards achieving goals which one is the most important

i. Project goals first followed by company's goals
ii. Company's goals first followed by project goals

22. Which of these do you give much attention to on a project?

a. Commitment to project objectives b. Commitment to firm objectives

23. What measures do you use to enhance personnel commitment to project objectives?
.....
.....
.....

24. Which leadership style do you usually apply on a project?

a. Situational b. Autocratic c. Democratic d. Other, please state.....

25. Which of these form the major number of labour force of artisans in your company?

i. Casual workers ii. Permanent workers

26. Do you usually motivate your workforce?

i. Yes ii. No

27. When do you motivate your workforce?

i. When delay is eminent ii. Throughout the project

28. In the case of unforeseen occurrences, do you use motivation as a means of avoiding delays?

i. Yes ii. No

29. Is motivation aimed at controlling project time?

i. Yes ii. No

30. Which form of motivation do you usually use?

i. Financial ii. Non-financial iii. Identifying needs and satisfying it

31. Do you use motivation factors such as punishments?

a. Yes b. No

32. When a job is poorly done and must be done over, how do plan it such that it does not delay the project.

33. In cases where the delay was no fault of yours, how best do you manage it?

a. Apply for extension of time b. Plan program to complete within the completion period
c. Seek advice from consultant and client d. All e. Other please state.....

34. By what means do you communicate urgent instructions?

i. Letters ii. Telephone iii. Fax

35. Do you have communication barriers?

i. Yes ii. No

36. If the answer to 35 is yes, how do you manage it?

37. Does information always reach you at the right time?

a. Yes b. No

38. Do you always dispatch information at the right time?

a. Yes b. No

39. If answer to 37 or 38 is No, what measures do you put in place to minimise them?

40. Do you always have the lines of communication clearly stated in each project?

a. Yes b. No

41. Has unclear lines of communication ever affected the performance of an activity on a project?

- a. Yes b. No

42. Have you ever encountered a situation where information was misplaced?

- a. Yes b. No

43. If answer to 42 is yes how frequent is it?

- a. Once in a while b. Often c. Very often d. Non applicable

44. Have management practices ever been the cause of delay on a project?

- a. Yes b. No

45. Have you ever received drawings that were not very detailed enough for use on site?

- a. Yes b. No

46. Do you use the works programme to set standards of performance on time when controlling projects

- a. Yes b. No

47. If answer to 46 is No, which other means do, you use to set standards of performance on time when controlling projects?

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48. How do you measure progress?

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49. How do you determine delays?

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50. What control measures do you use in controlling and monitoring progress?

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51. In cases where delay is eminent what control measures do you use to avoid or minimise delay?

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52. Do you crush programmes?
i. Yes ii. No

53. How do you manage the problem of dealing with unreliable nominated subcontractors and suppliers?

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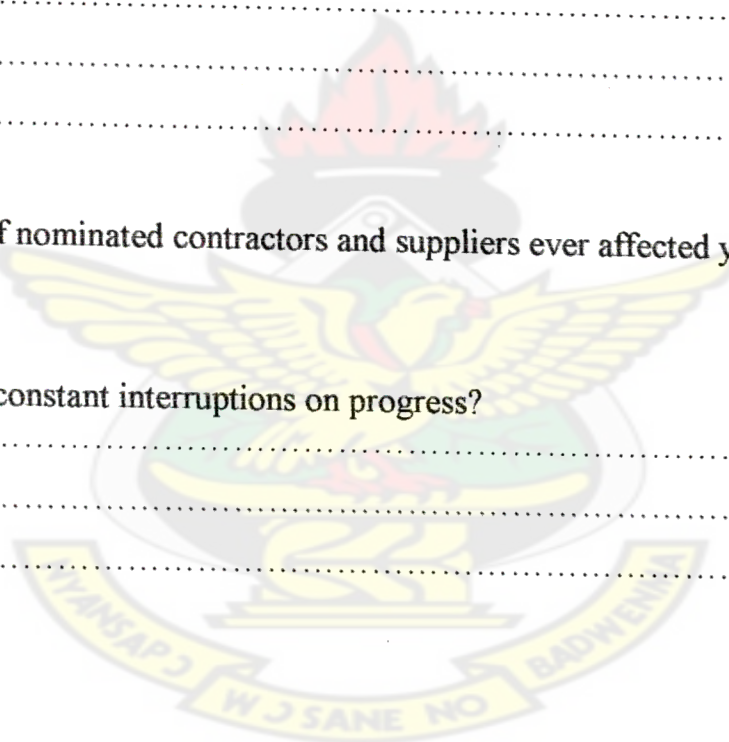
54. Has the performance of nominated contractors and suppliers ever affected your works progress?
a. Yes b. No

55. How do you deal with constant interruptions on progress?

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SECTION 3- Clients

1. How do you plan to pay your contractors?
 - i. When certificates are prepared
 - ii. From a cost plan prepared from works programme
2. Does your company plans reflect project plans?
 - i. Yes
 - ii. No
3. Do you usually get a copy of the contractors' works program?
 - i. Yes
 - ii. No
4. In the case of unforeseen occurrences, do you use motivation as a means of avoiding delays?
 - i. Yes
 - ii. No
5. Which form of motivation do you usually use?
 - i. Financial
 - ii. Non-financial
 - iii. Identifying needs and satisfying it?
6. Do you use motivation factors such as punishments?
 - a. Yes
 - b. No
7. Is motivation aimed at controlling project time?
 - i. Yes
 - ii. No
8. On what basis do you set time constraints?
 - a. When the building will be needed
 - b. Advice from consultants on the minimum time the building can be completed
 - c. Both
9. How are decisions taken for changes in a project?
 - a. By set up committees
 - b. Series of meetings by estate department
 - c. Other, please state.....
10. How long does it usually take to make a decision regarding changes on a project?

- a. 1-3 days b. 3-5 days c. 1 week d. 1-2 weeks e. Within a month.

11. Has the decision making period ever affected the progress of the project?

- a. Yes b. No

12. Do you emphasis on the major constraints for every project?

- i. Yes ii. No

13. When do you communicate changes in design?

- i. When decisions come to mind ii. Plan from the works program iii. Both iv Other,
please state.....

14. By what means do you communicate urgent instructions?

- i. Letters ii. Telephone iii. Fax

15. Do you have problems with communication barriers?

- i. Yes ii. No

16. If the answer to 15 is yes, how do you manage it?

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17. Does information always reach you at the right time?

- a. Yes b. No

18. Do you always dispatch information at the right time?

- a. Yes b. No

19. If answer to 17 or 18 is No, what measures do you put in place to minimise them?

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20. Do you always have the lines of communication clearly stated in each project?
a. Yes b. No
21. Has unclear lines of communication ever affected the performance of an activity on a project.
a. Yes b. No
22. Have you ever encountered a situation where information was misplaced?
a. Yes b. No
23. If answer to 22 is yes how frequent is it?
a. Once in a while b. Often c. Very often d. Non applicable.
24. Which leadership style do you usually apply on a project?
a. Situational b. Autocratic c. Democratic d. Other, please state.....
25. In prioritising the skills of the project manager for selection, which of these will you consider important?
i. Technical ii. Managerial iii. Approval knowledge and balance of the two
26. In coordinating activities towards achieving goals which one is the most important
i. Project goals first followed by company's goals
ii. Company's goals first followed by project goals
27. Which of these do you give much attention to on a project?
a. Commitment to project objectives b. Commitment to firm objectives
28. What measures do you use to enhance personnel commitment to project objectives?.....
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29. On what basis do you determine contractor and suppliers experience?
a. Previous works b. Profile c. Recommendation by others d. All

30. How do you avoid work overload?

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31. How do you deal with constant interruptions on progress?

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32. In cases where delay is eminent what control measures do you use to avoid or minimise delay?

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33. Do you use the works programme to set standards of performance on time when controlling projects

a. Yes b. No

34. If answer to 33 is No, which other means do, you use to set standards of performance on time when controlling projects?

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35. How do you measure progress?

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36. How do you determine delays?

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SECTION 3- Consultants

1. What planning technique do you normally use to plan your projects?
i. Bar chart ii. Network diagram iii. Line of balance iv. Pert
2. Is your planning technique able to detect critical activities?
i. Yes ii. No
3. Do you prepare plans for the client to use in taking strategic decisions?
i. Yes ii. No
4. Does the planning technique used for controlling projects able to determine total floats?
a. Yes b. No
5. When do you carry out most of the planning activities for a project with regards to what is to be done and when to do it?
a. Pre-contract stage b. Post-contract stage
6. Does your company plans reflect project plans?
i. Yes ii. No
7. Do you have an organizational structure for every project?
i. Yes ii. No
8. Do you have an organizational structure indicating roles, responsibilities and communicating channels for the other members forming the consultancy team?
i. Yes ii. No
9. If answer to 8 is No, which other means do, you use to define and detail roles and job description of personnel on a project?
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10. Do you usually motivate team members?
i. Yes ii. No
11. When do you motivate team members?
i. When delay is eminent ii. Throughout the project
12. In the case of unforeseen occurrences, do you use motivation as a means of avoiding delays
i. Yes ii. No
13. Is motivation aimed at controlling project time?
i. Yes ii. No
14. Which form of motivation do you usually use?
i. Financial ii. Non-financial iii. Identifying needs and satisfying it

15. Do you use motivation factors such as punishments?
a. Yes b. No
16. Is motivation aimed at controlling project time?
i. Yes ii. No
17. What is the maximum number of projects to which each personnel is assigned to in your firm?
i. 1 ii. 2 iii. 3 iv. 4 v. 5 vi. 6 vii. More than 6
18. Have you ever rejected a contact before?
i. Yes ii. No
19. If answer to 18 is yes what was the reason?
i. Current work load ii. Cannot work with other project party members
iii. Both iv. Other, please state.....
20. How do you avoid work overload?
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21. On what basis do you determine contractor and suppliers experience?
a. Previous works b. Profile c. Recommendation by others d. All
22. Have you ever encountered a situation whereby major decisions regarding changes in design were made at a time that works already completed had to be removed?
i. Yes ii. No
23. In coordinating activities towards achieving goals which one is the most important?
i. Project goals first followed by company's goals
ii. Company's goals first followed by project goals
24. Which of these do you give much attention to on a project?
a. Commitment to project objectives b. Commitment to firm objectives
25. What measures do you use to enhance personnel commitment to project objectives?
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26. Which leadership style do you usually apply on a project?
a. Situational b. Autocratic c. Democratic d. Other, please state.....
27. How do you enhance coordination between the design team and or project team?
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28. As a lead consultant, how do you deal with the situation of working with a design team member who does not perform his duties well?

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29. How do you deal with constant interruptions on progress?

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30. Does information always reach you at the right time?
a. Yes b. No

31. Do you always dispatch information at the right time?
a. Yes b. No

32. If answer to 30 or 31 is No, what measures do you put in place to minimise them?

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33. Do you always have the lines of communication clearly stated in each project?
a. Yes b. No

34. Has unclear lines of communication ever affected the performance of an activity on a project.
a. Yes b. No

35. By what means do you communicate urgent instructions?
i. Letters ii. Telephone iii. Fax

36. Do you have problems with communication barriers?
i. Yes ii. No

37. If the answer to 36 is yes, how do you manage it?

38. Have you ever encountered a situation where information was misplaced?
a. Yes b. No

39. If answer to 38 is yes how frequent is it?
a. Once in a while b. Often c. Very often d. Non applicable

40. Do you use the works programme to set standards of performance on time when controlling projects
a. Yes b. No

41. If answer to 40 is No, which other means do, you use to set standards of performance on time when controlling projects?

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42. How do you measure progress?

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43. How do you determine delays?

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44. What control measures do you use in controlling and monitoring progress?

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45. In cases where delay is eminent what control measures do you use to avoid or minimise delay?

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46. Do you crush programmes?

i. Yes ii. No,

APPENDIX B

CROSS TABULATION TABLES

Table B1 Cross tabulation of Organising by Party

ORGANISING	Count	PARTY			Row Total
		Client	Consultant	Contractor	
		1	2	3	
N/A	0	27	27	37	91 82.7
Very Weak	1	51	58	97	206 187.3
Weak	2	36	80	76	192 174.5
Fair	3	88	49	64	201 182.7
Strong	4	86	134	89	309 280.9
Very Strong	5	96	144	81	321 291.8
Column Total		32 29.1	41 37.3	37 33.6	110 100.0

Table B2 Cross tabulation of Directing by Party

DIRECTING	Count	PARTY			Row Total
		Client	Consultant	Contractor	
		1	2	3	
N/A	0	5	45	30	80 72.7
Very Weak	1	89	92	89	270 245.5
Weak	2	50	55	85	190 172.7
Fair	3	96	90	84	270 245.5
Strong	4	81	140	79	300 272.7
Very Strong	5	63	70	77	210 190.9
Column Total		32 29.1	41 37.3	37 33.6	110 100.0

Table B3 Cross tabulation of Planning by Party

PLANNING	Count	PARTY			Row Total
		Client	Consultant	Contractor	
		1	2	3	
N/A	0	11	16	13	40 36.4
Very Weak	1	64	62	49	175 159.1
Weak	2	79	76	95	250 227.3
Fair	3	87	77	55	219 199.1
Strong	4	107	155	150	412 374.5
Very Strong	5	100	188	156	444 403.6
Column Total		32 29.1	41 37.3	37 33.6	110 100.0

Table B4 Cross tabulation of Staffing by Party

STAFFING	Count	PARTY			Row Total
		Client	Consultant	Contractor	
		1	2	3	
N/A	0	0	8	12	20 18.2
Very Weak	1	28	45	13	86 78.2
Weak	2	30	44	44	118 107.3
Fair	3	58	68	59	185 168.2
Strong	4	56	51	49	156 141.8
Very Strong	5	52	71	82	205 186.4
Column Total		32 29.1	41 37.3	37 33.6	110 100.0

Table B5 Cross tabulation of Controlling by Party

CONTROLLING	Count	PARTY			Row Total
		Client	Consultant	Contractor	
		1	2	3	
N/A	0	0	2	0	2 1.8
Very Weak	1	14	34	12	60 54.5
Weak	2	15	9	13	37 33.6
Fair	3	36	28	26	90 81.8
Strong	4	41	37	53	131 119.1
Very Strong	5	22	54	44	120 109.1
Column Total		32 29.1	41 37.3	37 33.6	110 100.0

APPENDIX C

DESCRIPTIVE STATISTICS TABLES

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
s3_1	110	3	0	3	0.845454545	0.064816883	0.679805202	0.462135113
s3_2	110	2	0	2	0.954545455	0.070012942	0.734301936	0.539199333
s3_3	110	1	1	2	1.218181818	0.039559329	0.414901739	0.172143453
s3_4	110	3	0	3	0.454545455	0.069113731	0.72487093	0.525437865
s3_5	110	3	0	3	0.545454545	0.080279291	0.841976308	0.708924103
s3_6	110	2	0	2	0.436363636	0.063963178	0.670851475	0.450041701
s3_7	110	3	0	3	0.763636364	0.105659115	1.108162151	1.228023353
s3_8	110	5	0	5	0.936363636	0.149101995	1.563794918	2.445454545
s3_9	110	2	0	2	0.563636364	0.080165875	0.840786795	0.706922435
s3_10	110	2	0	2	1.227272727	0.083360498	0.874292279	0.764386989
s3_11	110	2	0	2	0.836363636	0.059923878	0.628486937	0.39499583
s3_12	110	2	0	2	1.027272727	0.074707203	0.783535751	0.613928274
s3_13	110	2	0	2	0.390909091	0.056437843	0.59192509	0.350375313
s3_14	110	3	0	3	0.754545455	0.1134686	1.190068718	1.416263553
s3_15	110	2	0	2	0.945454545	0.069354661	0.727397821	0.52910759
s3_16	110	2	0	2	0.354545455	0.047605488	0.499290573	0.249291076
s3_17	110	6	0	6	2.790909091	0.221863912	2.326928339	5.414595496
s3_18	110	2	0	2	0.990909091	0.072481863	0.760196191	0.577898249
s3_19	110	4	0	4	1.581818182	0.151930484	1.593460363	2.53911593
s3_20	110	8	1	9	4.336363636	0.223056811	2.339439566	5.472977481
s3_21	110	1	1	2	1.336363636	0.045253936	0.474627285	0.225271059
s3_22	110	1	1	2	1.263636364	0.042202247	0.4426209	0.195913261
s3_23	110	7	1	8	4.036363636	0.211009438	2.213085657	4.897748123
s3_24	110	2	1	3	2.309090909	0.089242437	0.935982578	0.876063386
s3_25	110	2	0	2	0.609090909	0.084785413	0.889236912	0.790742285

Descriptive

Statistics(continued)

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
s3_26	110	2	0	2	0.754545455	0.050330623	0.527872024	0.278648874
s3_27	110	2	0	2	1.154545455	0.080848672	0.847948021	0.719015847
s3_28	110	1	1	2	1.227272727	0.040139646	0.420988154	0.177231026
s3_29	110	1	1	2	1.127272727	0.031922265	0.334803541	0.112093411
s3_30	110	2	1	3	1.645454545	0.087201284	0.914574786	0.836447039
s3_31	110	1	1	2	1.8	0.038313051	0.401830673	0.16146789
s3_32	110	4	0	4	0.672727273	0.105011291	1.101367714	1.213010842
s3_33	110	4	0	4	0.536363636	0.094623853	0.99242334	0.984904087
s3_34	110	2	1	3	2.036363636	0.040693063	0.426792447	0.182151793
s3_35	110	1	1	2	1.709090909	0.043502714	0.456260318	0.208173478
s3_36	110	1	1	2	1.727272727	0.042657921	0.447400051	0.200166806
s3_37	110	1	1	2	1.681818182	0.044612722	0.467902173	0.218932444
s3_38	110	1	1	2	1.481818182	0.04785964	0.50195614	0.251959967
s3_39	110	7	1	8	3.163636364	0.210058681	2.203114029	4.853711426
s3_40	110	1	1	2	1.536363636	0.047764492	0.500958214	0.250959133
s3_41	110	1	1	2	1.2	0.038313051	0.401830673	0.16146789
s3_42	110	1	1	2	1.172727273	0.036206918	0.379741363	0.144203503
s3_43	110	3	1	4	1.490909091	0.106302992	1.114915182	1.243035863
s3_44	110	1	0	1	0.336363636	0.045253936	0.474627285	0.225271059
s3_45	110	1	0	1	0.336363636	0.045253936	0.474627285	0.225271059
s3_46	110	1	1	2	1.172727273	0.036206918	0.379741363	0.144203503
s3_47	110	4	1	5	1.354545455	0.08623954	0.90448793	0.818098415
s3_48	110	3	1	4	2.063636364	0.034840929	0.365414751	0.13352794
s3_49	110	4	1	5	1.290909091	0.073453422	0.770385993	0.593494579
s3_50	110	4	0	4	0.790909091	0.0646998	0.678577229	0.460467056

Descriptive
Statistics(continued)

	N Statistic	Range Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic	Variance Statistic
s3_51	110	8	1	9	3.318181818	0.233167913	2.445485705	5.980400334
s3_52	110	2	0	2	1.081818182	0.077633705	0.81422917	0.662969141
s3_53	110	2	0	2	0.345454545	0.049072063	0.514672135	0.264887406
s3_54	110	2	0	2	0.345454545	0.047341965	0.496526719	0.246538782
s3_55	110	3	1	4	1.881818182	0.102293807	1.072866504	1.151042535
s3a_1	110	2	0	2	0.436363636	0.0701806	0.736060338	0.541784821
s3a_3	110	2	0	2	0.327272727	0.051837127	0.543672374	0.29557965
s3a_8	110	3	0	3	0.672727273	0.110431024	1.158210348	1.341451209
s3a_9	110	3	0	3	0.5	0.086397649	0.90614619	0.821100917
s3a_10	110	4	0	4	0.690909091	0.120289791	1.26160997	1.591659716
s3a_11	110	2	0	2	0.354545455	0.057158696	0.599485462	0.359382819
s3a_12	110	2	0	2	0.427272727	0.068899476	0.722623799	0.522185154
s3a_13	110	3	0	3	0.436363636	0.078057391	0.818672821	0.670225188
s3a_25	110	3	0	3	0.718181818	0.114161423	1.1973351	1.433611343
s3a_29	110	4	0	4	1.045454545	0.160994803	1.688527743	2.851125938
s3b_3	110	2	0	2	0.572727273	0.07690759	0.806613613	0.650625521
s3b_8	110	2	0	2	0.5	0.068035707	0.713564511	0.509174312
s3b_9	110	2	1	3	1.209090909	0.05494019	0.576217571	0.332026689
s3b_21	110	4	0	4	1.227272727	0.166732365	1.748703797	3.057964971
s3b_27	110	6	0	6	1.236363636	0.173242286	1.81698042	3.301417848
s3b_28	110	6	0	6	1.154545455	0.163971948	1.719752295	2.957547957