KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF ARCHITECTURE AND PLANNING

DEPARTMENT OF BUILDING TECHNOLOGY

DISSERTATION REPORT

KEY CAUSES OF DELAY IN CONSTRUCTION PROJECTS – VIEWS OF GHANAIAN D3K3 AND A3B3 CONTRACTORS.

Dissertation presented to the Department of Building Technology in partial fulfilment of the requirements of the Master of Science Degree in Construction Management

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NOVEMBER, 2014

DECLARATION

I hereby declare that, this project report is my own work towards the award of MSc. Degree in Construction Management and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of this University or other, except where due acknowledgment has been made in the text.

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ABSTRACT

Delay is among the key challenges faced in the course of construction project implementation. Construction project delay is a global problem in project delivery. Several attempts by researchers' and project professionals to tackle this problem have not yielded sufficient positive results. This has great negative impact in terms of cost and risk in construction projects with its related effects on contracting parties. The aim of this study was to identify the key causes of construction project delays in the view of small scale Ghanaian contractors. Hence, in achieving the aim of the study the following specific objectives were advanced, one, to identify the most important causes of delay and two, to identify solution to the causes of delays. The study adopted a quantitative structured questionnaire survey. Respondents were selected by the quota sampling technique. Out of Seventy one (71) questionnaires distributed, Sixty Four (64) were retrieved from respondents representing Ninety percent (90). Relative Importance Index and Factor Analysis were used to analyze objective one and two data respectively. The study revealed that, the main causes of delays are: Clients inadequate financial resources, delays in honouring payment certificates for work done, underestimation of the project duration, poor communication between contracting parties and complexity for developers to access bank credit. In concluding, the following measures were espoused for effective construction delivery: initial proper planning, establishing appropriate communication media and sticking to payment schedules agreed by all the contracting parties.

KEYS WORDS: Causes, delay, construction, projects, Ghana, contractors

DEDICATION

I dedicate this piece of work to the Almighty God for taking me to this level in life. Indeed for His protection and guidance, Amen. Second dedication goes to my loving and caring wife Vivian Acheampomaa Fobi for her understanding and support throughout this period. Also to my children Michael Appiah Nuamah Fobi, Cathrine Abena Nhyiraba Fobi, Benedicta Yaa Ankomah Fobi and Nana Yaw Kissi Fobi (Junior) for their support and sympathy I am most grateful.

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INTRODUCTION

1.0: BACKGROUND OF THE STUDY

Construction delay can be defined as execute later than intended planned, or later than specific time that all the concerned parties agreed for construction project (Chan and Kumaraswamy, 1997). According to Assaf and Al-Hejj (2006) construction delay is a universal evident reality, however most countries faced this global fact. In the study conducted by Okumbe and Verste (2008) revealed that delay in construction project delivery is a universal phenomenon, it is termed as one of the expensive and risky problem encountered in construction projects with its associated effects on contracting parties. Moreover its impacts are not only confined to the construction industry but they influence the overall economy of a country. Keane and Caletka (2008) in their quest to analyzed delay in contracrion project in United Kingdom said, construction industry involves complex and dynamic processes, that consists of effective coordination of multiple discrete business units such as trade professionals, skilled labour, manufacturers, trade unions, financiers, local authorities, contractors and others. Sweis et al. (2008) believed successful completion of construction projects leads to wealth creation, socio-economic growth and improved standards of living and. Nations are evaluated as "developed", "developing" and "underdeveloped" based on the quantity and quality of completed construction projects in their domain (Abdullah et al., 2011). According to AGC of America (2003), project financers inability to meet all their contractual payment obligations to contractors are a continuing reasons of litigation, arbitration, lies, and long delays in completion of construction, abandonment of contracts, and bankruptcy of contractors and subcontractors. According to Sambasivan and Soon (2007) delays are treacherous often resulting in time extension, cost overrun, abandonment of projects, disagreements and litigation.

Relative studies have revealed that the causes of construction project delays vary from country to country. According to Tucker et al. (1999), five (5) critical factors causing delays in the United State construction industry are; approval for building authorization, changes in order, changes in design, lack of complete documentations, and inspection pressures by statutory bodies. Fugar and Agyakwah-Baah (2010) study on causes of delay in building construction projects came out with these factors as main causes of delay in project execution Ghana. The factors identified includes; delays in honoring payment certificates, underestimation of the project costs, underestimation of the project's complexity, difficulties in accessing bank credit and poor supervision of the works on site etc. Enshassi et al., (2009) also said delay is most recurring problems in the construction industry and a common global phenomenon. They see causes of delay having undesirable consequences on projects success in terms of quality, cost, time and safety.

1.1: PROBLEM STATEMENT

There are number of construction projects in this country that are delayed during their pre-contract and post contract stages. For examples infrastructure development relating to the Ghana Jubilee Oilfield Gas Project which was expected to be completed in December 2013 and later extended to April, 2014 were still on-going as at May 2014 (GNA, 2014). China's SINOPEC, the main contractor for Ghana's Jubilee Oilfield Gas Project and which has been pre-financing the project has threatened to abandon the project following problems relating to payments from the government (Ghanaoilonline, 2014).

There are other high profile examples around the country. For example, contractors working on four major road projects which are part of 'Gang of Six' roads have abandoned the project site for lack of payment and other pertinent technical issues with government (Bentil, 2014) . According to the report, inability for these projects to be completed on time brings serious

challenges to vehicular movement, loss of jobs as well as the inhabitants in the neighborhood feeling uncomfortable due to dust and pollutions causing health hazards.

Protracted delays in projects in Ghana are not limited to only large-scale projects. In Asunafo North Municipal Assembly, six (6) out of twelve (12) construction projects that were awarded in 2008 and were expected to be completed in 2009 remains at various levels of completion with some abandoned by their respective contractors (Auditor General's Department, 2012). When construction projects are delayed then, there is a likelihood of cost overruns. In another example in Asunafo North Municipal Assembly, construction of 6-unit classroom block with ancillary facilities that was awarded in 2008 at a contract sum of GH¢ 105,000.00 and expected to be completed 2009 was abandoned at roofing level and awarded to a new contractor at GH¢ 95,000.00, after the first contractor has been paid GH¢ 68,000.00. According to Ahmed et al. (2000), construction projects delays present many adverse effects such as adversarial relationships, disbelief, lawsuit, cash-flow problems, project abandonment and many other issues which impact negatively on project costs. The above problems necessitated this study thus, key causes of delay in construction projects from the viewpoint of small scale Ghanaian contractor.

1.2: RESEARCH QUESTIONS

This dissertation intends to answer the following questions:

1. What are the causes of delay in construction projects in Ghana?
2. What are solutions to reduce causes of delay in Ghana?

1. 3: AIM OF THE STUDY

The aim of this study is to identify the most important causes of construction project delays in the perspective of small scale Ghanaian contractors' and address these causes.

1.4: OBJECTIVES OF THE STUDY

In achieving the aim of the study the following objectives were set:

- To identify the most important causes of delay from the perspective of small scale Ghanaian contractors; and
- To identify solutions to curb delays in construction projects.

1.5: SIGNIFICANCE OF THE STUDY

The findings of this study would address the most important causes of delay in construction projects in Ghana. It would broaden knowledge with issues related to most important causes of delay in construction projects including management, planning and schedules of projects in Ghana and the Ghanaian Construction Industry (GCI) as a whole. The outcome that is, analysis, results and recommendations derived from this study would serve as points of reference in further studies on this subject matter.

1.6: SCOPE OF THE STUDY

The study covered the Ghanaian Construction Industry only, specifically contractors' working in Brong Ahafo region. The research focused was on only Ghanaian Building and Road Contractors' within the Financial Class D3K3 and A3B3 respectively.

1.7: METHODOLOGY

A quantitative strategy was adopted for the research due to the fact that quantitative research allows for greater accuracy and objectivity of results to be obtained. This research approach has the advantage of being unbiased, objective and closed (Dawson, 2002). Quantitative research generates rich, detailed and valid data that contributes to in-depth understanding of the context of the research area. The research style adopted was survey research method with structured open and close ended questionnaires were distributed to target respondents for responses. Quantitative research approach was used. Data were gathered from journal

papers, textbooks, internet (world-wide-web), personal interaction with contractors and construction professionals. The questionnaires adopted to get feedback on opinions of respondents about the most important causes and solution to causes of delay in construction projects in Ghana. Non probability sampling method called Quota sampling technique was used and sampling size was determined by the use of Kish (1965) formula.

1.8: APPROACHES TO ANALYSIS OF RESULTS

Statistical Package for the Social Science (SPSS) software tool and Microsoft Excel were employed in analyzing the initial data collected for the generation of frequencies and percentage tables. Further analysis adopted Relative Importance Index (RII), since the aim of the study is to identify the most important causes of project delays to Ghanaian projects from the contractor perspective and address these causes. Formula used to calculate the relative importance value of each variable is stated below;

Relative important index (RII) =$\sum$PiUi/N(n)

Where, RII = relative importance index

Pi = respondent's rating of cause of delay

Ui = number of respondents placing identical weighting/rating on cause of delay

N = sample size and n = the highest attainable score on cause of delay

1.9: LIMITATIONS

The study was only limited to contractors working in the Brong Ahafo region of Ghanaian. Again only D3K3 Building contractors and Road contractors in the A3B3 category of Ghanaian contractors were surveyed. Any generalization from these studies should consider these limitations.

1.10: STRUCTURE OF THE DISSERTATION

The research was divided into chapters as discussed below;

Chapter one is the introduction to the research. The chapter has in its content the statement of problem, the aims and objectives of the research. The background for undertaking the research is presented in the chapter.

Chapter two was about literature review on the causes and identified solutions to delay in construction projects and their effects in construction projects. It's also contains definitions and theories of delay by pervious researchers and the various classifications of delay.

Chapter three contains the approach and method used in the research to achieve the stated objectives. Methods and techniques used in data collection, analyses and interpretation are presented.

Chapter four presents the analysis of the data collected through the questionnaires obtained. A discussion of the responses is contained in this chapter.

Chapter five presents a conclusion of the research and the achievements of the research objectives. The recommendation based on the findings has being made.

Appendices contain materials that are related to the study but would make the body of the study bulky. This material includes questionnaires.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

Chapter one was on the introduction to the research. It introduced the background, aim, objectives and justification for the research in identifying the key causes of delay in construction projects - views of Ghanaian contractors. This chapter will review literature on the most important causes of delays in construction projects. The chapter will also develop solutions to the most important causes of delay in construction projects in Ghana.

2.1: DEFINITIONS FOR CAUSES OF DELAY

Lo et al. (2006) define delay as the slowing down of work without stopping construction entirely and that can lead to time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project. In the study conducted by Okumbe and Verste (2008), in as much as its point to the that delay is a universal phenomenon in construction project delivery, it is marked predominant, expensive and risky problem encountered in construction projects with its devastating effects on the parties to the contract. Moreover it impacts are not only confined to the construction industry but they influence the overall economy of a country. Delay is one of the most recurring problems in the construction industry and a common global phenomenon (Enshassi et al., 2009). The authors see causes of delays having expensive, dangerous and undesirable consequences on project success in terms of time and cost.

2.2: BACKGROUND TO DELAYS IN CONSTRUCTION PROJECTS

Several attempts by project professionals and researchers to tackle the causes and effects of construction project delays have not yielded sufficient positive results (Sambasivan and Soon, 2007). According to Aibinu and Odeyinka (2006), even with today's knowledge in technology, and organization management understanding of project techniques, construction projects continue to suffer delay and project completion dates still get pushed back. In construction, the word "delay'' refers to something happening at a later time than planned, expected, specified in a contract or beyond the date that the parties agreed upon for the delivery of a project (Pickavance, 2005). In Ankara Turkey, Dayi (2010) conducted a study on construction project delays and identified that, delay may happen in the preconstruction phase which is defined as the period beginning from the initial conception of the project to the signing of the contract between the owner and the contractor; however most project delays happen in the construction phase that is the period when actual construction is under way. He further discussed several controllable and uncontrollable factors that can adversely affect the project schedule and cause delays. According to the author delays definitely create negative impacts on project performance. He also said schedule delays in the completion of a construction project may be a major difficulty for contractors leading to costly disputes and adverse relationships between project participants. Akinsola (1996) study came out that when projects are delayed, they are either giving time extended or the project activities accelerated and therefore, incur additional cost. Bestowing to him, the normal practices usually allow a percentage of the project cost as a contingency allowance in the contract price and this allowance is usually based on judgment. Although the contract parties agree upon the extra time and cost related with delay, in many cases there are problems between the clients and contractors as to whether the contractor is entitled to claim the extra cost (Akinsola, 1996). Delays in construction projects cause dissatisfaction to all parties involved and the main role

of the project manager is to make sure that projects are completed within the budgeted, time and cost (Long et al. 2004). Their study established that, several studies have been undertaken on factors causing delays and cost overruns and their effects on quality, safety and output are the common difficulties in some types of projects. Ochoa (2013) said the success or failure of a commercial construction project depends largely on the construction schedule and whether that schedule is reality and can be met. Delays in the construction schedule negatively impact both owners and contractors. In as much as delays cause owners to absorb or pay additional costs and still do not being able to use or occupy their property for its intended purpose (Ochoa, 2013). Keane and Caletka (2008) said construction is an industry that involves complex and dynamic processes. They further said construction project consists of successful coordination of multiple distinct business units such as trade professionals, skill labour, manufacturers, trade unions, financiers, local authorities, trade contractors and others construction projects impact on a nation's economy. Successful completion of construction projects leads to wealth creation; socio-economic growth and improved standards of living (Sweis et al., 2008) quoted by (Memon et al., 2011). According to Abdullah et al. (2011) nations are evaluated as "developed", "developing" and "underdeveloped" based on the quantity and quality of completed construction projects in their domain. Construction delays are commonly experienced in public sector but it also exist in both public and private sector projects (Yang et al., 2010).

2.3: CLASSIFICATION OF DELAYS

Delays in construction projects are almost inevitable. Delay in projects start at pre-contract stage while others happened at construction stage (Al-Hamaidia and Tanb, 2010) and (Yang and Wei, 2010). Scott (1993) identified three major categories of delays namely: employer's responsible delay; contractor's responsible delay and "neither" party responsible delay. Ahmed et al. (2003) and Ochoa (2013) are of the opinion that delay could be categories into

non-excusable; excusable (with or without compensation) and concurrent delays. Trauner et al. (2009) discussed four main categories of construction delays as: Critical or non-critical, Excusable or non-excusable Compensable or non-compensable and Concurrent or non-concurrent.

2.3.1: Excusable or non-excusable delays

Construction delays are basically either excusable or non-excusable. Ochoa (2013), Trauner et al. (2009) Ahmed et al. (2003) notice that whether a delay is excusable or non-excusable depends on the clauses in the contract. The authors said that, standard construction contracts specify types of delay that will permit the contractor an addition time to complete the work. Example in some contracts, unanticipated weather conditions are not considered as excusable and so these contracts do not allow for any time extensions. An excusable delay in general is owing to an unforeseeable event beyond the contractors or the subcontractors' control (Trauner et al., 2009). The author further explained that, delays resulting from the following issues are known as excusable delays: general labor strikes, fires, floods, Acts of God, client variation, mistakes and errors in specifications, variation in site conditions or buried services, abnormally weather condition etc. In another study Levy, (2006) adds two more excusable delays to the above list as: illness or death of one or more of the contractors and transportation delays over which the contractor has no control.

2.3.2: Compensable versus Non-compensable Delays

Ochoa (2013); Trauner et al. (2009); Ahmed et al. (2003) and Mubarak (2005) ascertained that an excusable delay can be classified as "excusable compensable" and "excusable non-compensable". Compensable delays are caused by either owner or the designer engineer/ architect (Mubarak, 2005). In such situation the contractor is typically entitle to a time extension or recovery of the costs related with the delay, or both. Trainer (2009) said factors which are specified in the contract resulting in delays such as differing site conditions,

changes in the work, access to the site are some examples of compensable delays. The author further explained non-compensable delays as those which despite being excusable do not entitle the contractor to any compensation. Mubarak (2005), point out that excusable non - compensable delays are normally beyond the control of either owner or contractor such as bad weather conditions, force majeure , conflicts, national crises, floods, fires or labor strikes. She adds that usually the contractor is entitled to a time extension, but not additional compensation. Trauner et al. (2009) study emphasized that delay is either compensable or non-compensable essentially depends on the conditions of the contract. The condition of contract will determine the types of delays that require time extension or monetary compensation.

2.3.3: Concurrent Delays

Concurrent delay includes a combination of two or more independent causes of delay occurring within the same time frame (Mubarak, 2005). Concurrent delay often includes excusable and non-excusable delays. Trauner et al. (2009) concurrent delays are simply defined as "separate delays to the critical path that occur at the same time". Levy (2006) terms this kind of delays as overlapping delay. He indicated that concurrent delays may be generated by the contractor or the client. Levy (2006) further said when it happens, both parties are accountable and neither client nor the contractor can retrieve damages.

2.3.4 Critical or Noncritical Delays

The primary focus in any study of delays in a project is to see if the delay affects the progress of the entire project or the project completion date (Trauner et al., 2009). The authors' state that delays which outcome result in extension of project completion period is considered as critical delays and non-critical delays are delays that do not affect the project completion. Trauner et al. (2009) further claim that the issue of critical delays arises from the Critical Path Method forecast. Every project has a critical path and if these critical activities on the

path are delayed than the project completion date will be extended. The authors' said the criteria to determining the project completion date are as follows: the project itself, the contractor's duration with respect to the critical path activities, the activities sequence and phasing and the physical restraints of the project.

2.4: RELATED STUDIES ON CAUSES OF DELAYS

Related studies have revealed that the causes of delay vary from country to country.

The research conducted by Sunjka and Jacob (2013) came out with ten (10) most common causes of project delays in the Niger Delta region in Nigeria comprises youth unrest, combativeness and communal catastrophes, lack of proper planning by the contractors, delay or lack of payment of compensation to affected persons, wrong choice of consultants and contractors by the clients, weather condition; poor contract management by the consultants, late identification and resolution of drawings and specification errors and omissions by the consultants, lack of community buy-in, poor contract management by the consultants , inappropriate design by the consultants, unrealistic contract duration by the clients, poor coordination of subcontractors by the contractors. The following factors are causes of delay in construction projects delivery time: lack of funds to finance the project to completion, changes in design, lack of effective communication among contracting parties, lack of adequate information from consultants, slow decision making and contractor's insolvency. (Owolabi et al., 2014). In the Kingdom of Saudi Arabia (KSA) a study carried out by Albogamy et al. (2012) on addressing construction delays factors identified these as top ten (10) causing delays: Low performance of the lowest bidder contractor in the Government Tendering system, delays in sub-contractors work, poor qualification, skills and experience of the contractor's technical staff, poor planning and scheduling of the project by the contractor, delay in progress payments by the owner, shortage of qualified engineers, delay in preparation of shop drawings cash flow problems faced by the contractor, inadequate

early planning of the project, and non-utilization of professional construction contractual management.

A study in Tanzania on "causes of delays and disruptions and their effects on construction projects" established that, there are still a number of great risks that has effects on project performance. The research revealed that: variation in design during construction, delays in payment to contractors work done, delay in information flow, lack of funds for the project, poor site management, delay in compensation issues and dispute on the valuation of work done (Kikwasi, 2012). Looking at factors causing time delays on the 2010 FIFA World Cup stadia construction, Baloyi and Bekker (2011) in their study on causes of construction cost and time overruns identified the following as causes of delay: incomplete drawings; design changes; clients' slow decision-making; late issue of instructions; shortage of skilled labour; poor planning and scheduling; labour disputes; shortage of manpower; change orders by client during construction; poor information dissemination and delay in work approval. In an authors' quest to determine the causes of construction project delays in University Kebangsaan campus in Malaysia identified six (6) as critical causes of delay out of initial twenty two (22) factors identified the six (6) includes: insufficient capital; delay in getting progress payment; delay in getting work approval; contractor management problems; scarce insufficient construction materials and new instructions for additional works (Tawil et al., 2013). Fugar and Agyakwah-Baah (2010) study revealed that delay in construction projects are still widespread in Ghana. They explored a total of 32 factors causing delays in construction projects, which the research response (owner, professional consultants and contractors) ranked according to the factors order of importance. The results indicated top ten (10) factors associated with delays in construction projects in Ghana are: delays in honoring payment documentations, underestimation of the project budget, underestimation of the project's complication, difficulties in for project developers to access bank credit, poor

supervision of the works on site, underestimation of project duration by the contractors, material shortages, poor expert management, escalation of material prices and poor site management.

Delays are one of the biggest problems construction firms face in Libya. The authors believe that delays can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination. They further said, even though various studies have considered the causes of delays, these studies discussed common causes of delays in construction project in Libya as follows: inappropriate planning, absence of active communication, design mistakes, deficiency in materials supply, delay in decision making, lack of funds to pay for completed works, scarcity of material in the market, cash-flow difficulties during project implementation, increase in quantities and mismanagement by the contractor. (Saleh Al-Hadi et al, 2009). Sambasivan and Soon (2007) study identified the major causes of delay and their impact on projects completion in the Malaysian construction industry. The results indicated ten (10) major causes of delay in Malaysia comprises; contractor's inappropriate forecasting, contractors' poor site management, inadequate contractor knowledge with respect to the work, client's inadequate financial capital and delay in payments of work done by contractors, difficulties with subcontractors schedules, shortage in material supply, lack of skill labour supply, equipment accessibility and breakdown, deficiency of communication among contracting parties, and errors during construction phase. As project delay may have bad consequences for the project execution organization such as under budget, affect the firm reputable, etc. Azlan et al. (2011) pursuit to identified "Contractors' perception of factors contributing to project delay" which was a case study of commercial projects in Klang Valley, Malaysia came up with seven (7) factors that contribute to delay in commercial project as follows: contractors"

financial difficulties, construction mistakes and defective work, labour shortage, coordination problem, shortage of tools and equipment, material shortage and poor site management.

In an author's quest to determine causes of non-excusable delays of construction projects, used mean ranking method to rank 20 causes of non-excusable construction delays and came out with ten (10) as major causes. Namely: not selecting competent subcontractors, poor management of the project changes, lack of mechanism for recording, analyzing, and transferring project lessons learned, delay in forwarding material and equipment to the site, delay in awarding subcontractors' contracts, lack of effective managing and controlling subcontractors, delay in detail design by project engineer subcontractor, delay in supplying shortage of the equipment, poor management of project site, and lack of effective communication and management (Afshari et al., 2011). In Hong Kong a study conducted on "the dominant causes of construction delays in civil engineering projects" identified the following as predominant causes of delay; exceptionally low bid, inadequate resources due to contractor's lack of capital, inexperienced contractors, poor site management and poor supervision by consultants, unforeseen ground conditions, works in conflict with existing utilities (Lo et al., 2006). In Ghana, Frimpong et al. (2003) study identified five factors as causes of major delays in construction projects in Ghana, namely monthly: poor payment problems to contractors'; poor contract management; material procurement challenges; lack of competent technical performance and material price escalations. Effective and efficient project management was recommended as the ultimate solution to outcome time overruns in project implementation.

Based on quantitative analysis of construction delays by Al-Momani, (2000) on records of public building projects constructed in Jordan during the period of 1990 to1997 revealed that regression models of the relationship between actual and planned project duration for different types of building facilities differs. The researcher established that the following are

the main causes of delay in construction projects: changes orders during construction, severe weather condition, site conditions including conceal services, late material deliveries, poor economic conditions and poor bill of quantities preparation. Chan and Kumaraswamy (2002) identified five (5) principal delay factors, which are; poor risk management and supervision, unforeseen site conditions, slow decision making, client-initiated variations and work variations.

In Jordan, Battaineh (1999) evaluated the progress reports of 164 building and 28 highway projects constructed during the period 1996-1999. The results indicate that delays are extensive: the average ratio of actual completion time to the planned contract duration is 160.5% for road projects and 120.3% for building projects. In the United States, the study conducted by Tucker et al.(1999) came out with five (5) critical factors causing delays in the construction industry, they include; approval for building authorization, changes in order, changes in design, lack of complete documentations, and inspection pressures. According to Odeyinka and Yusuf (1997) some of major causes of construction delays are: Number of variation orders, slow decision making, financial/cash flow difficulties, resources management problems, planning and scheduling problems, inadequate site inspection and inclement weather, and labour disputes including strikes. Other delay factors in a study by Kamming et al. (1997) are classified under cost and time overruns. Under time overrun, the most important factors causing delays are: design changes, poor labor productivity, inadequate planning, and resource shortages.

According to Sunjka and Jacob (2013) in their quest to conduct a study on "Significant causes and effects of project delays in the Niger Delta Region" came out with "youth unrest, militancy and communal crises" as the most important cause of project delays in the Niger Delta. In as much as it was ranked first (1) among eleven (11) most important delay factors considered, that factors do not pertain here in Ghana.

2.4.1 Summary of causes of delay

Related studies above revealed that most of the causes of delay are common globally, examples are: Contractors improper planning during construction; Delays in honoring payment certificates for work done; Client's inadequate financial resources; Contractors poor site management; Underestimation of the project costs; Complexity and difficulties in accessing bank credit; Complexity, difficulties in accessing bank credit; Poor supervision of works on site; Underestimation of the project duration; Errors in design and specifications; Change orders during construction; Unforeseen site conditions; Weather condition; Poor communication between contracting parties; Delays in sub-contractors work; Bureaucracy in decision making ; Lack of complete documentations before commencement; Material price escalations; Material procurement difficulties and Building approval delays by statutory authorities etc.

2.5: EFFECTS OF DELAY TO CONTRACTORS

Effects of delay in construction projects could lead to; confrontational relationships, disbelief, lawsuit, cash-flow problems, project rejection and general sense of apprehension towards each other (Ahmed et al., 2000). The author further identified; inaccurate project estimation and price fluctuations as some of the causes of delay. Nwachukwu, (2009) used a systems approach to analyze the effects of materials constraints to project management success in construction in Nigeria. The study established that the attitude of the client and the project management team towards materials management is very important because it has a marked effect on the achievement of the project objectives. Especially delays in the procurement of materials could have negatively impact in construction programme and could result in delays and failure to achieve timely project delivery. A study on effects of project delivery in Nigerian construction industry discovered the following factors as the main effects in project delivery: working above scheduled thus, time overrun, project above budgeted cost thus, cost

overrun, disagreement, arbitration (ADR), total abandonment and lawsuit (Aibinu and Jagboro, 2002). The studies further established that delay of construction project for whatever reasons mostly lead to time extension. These extensions of time may lead to cost overrun where it involves extra financial disbursement. Dispute is another effect of delay, mostly between contractor and client for either extension of time or financial claims for under budget or variation. In construction most times, arbitration resolution is chosen to solve the dispute between contracting parties. The authors further explained that, if the issues are not resolve at the arbitration level then, litigation is the preceding step for the contracting parties.

The study by Kikwasi (2012) discovered that delays and disruptions in construction projects result to the following effects: time overrun, work exceeding plan budget, negative social impact, wasting resources with respect to labour and equipment and, disagreement resulting in dispute. Survey conducted by Kamming et al, (1997) of influencing factors on 31 high-rise projects in Indonesia revealed that cost overruns occur more frequently and are more severe than time overruns. They further explained that the key factors influencing cost overruns are inflation thus, material cost increase, incorrect material assessment and degree of complexities with respect to its availability and scarcity. Besides the causes of delay identified by Alzan et al. (2011), the author further identified six (6) effects of delay as per the analysis of the variables. They include: cost overrun and extension of time (EOT), rescheduling, affect company reputation, loss production and efficiency as the most common effects of delay in construction projects.

Li et al. (2000) argue that when delay occurs there are three possible situations that a project manager may be challenged with, thus, extra money to complete the work, compromising quality by reducing standards and specification and rework thus to modify the work. To solve the challenges above the project manager is often confronted with the ensuing options: either recommend overtime work and/or increase project resources both labour and

equipment in order to meet the project time. Increasing the project resources could lead to increase in project costs thus cost overrun. While without introducing overtime will lead to decline in productivity, whereas poor performance or workmanship could lead to rework. Sunjka and Jacob (2013) research also came out with three most important effects of project delays in the Niger Delta region, are: Time overrun, Budget (Cost) overrun and Disputes and claims. Time overrun and cost overrun are the two most significant effect of delay in Malaysian construction projects Sambasivan and Soon (2007) .The incidence of disputes is another common effect of construction delay. This dispute is normally between contractors and clients and it significantly affects the progress of construction projects. To minimize this dispute, Conlin and Retik (1997) recommended the use of schedule as contract document. In addition to that, a fair and effective evaluation of delay impact is possible if the most appropriate delay analysis method is selected. Arbitration, litigation and total abandonment seem to be the least frequent effects of construction delay.

In my quest to look at the effects identified by authors on the relative studies globally. The following was observed as the predominant effects in construction projects: Adversarial relationships; Distrust; Cash-flow problems; Time overturn; Cost overturn; Arbitration; Litigation and Total abandonment.

2.6: RECOMMENDED SOLUTIONS OF DELAY

1. Sambasivan and Soon (2007) recommendations on Causes and effects of delay in Malaysia construction industry were:

i. Prescriptions for the clients

While selecting the contractors, clients have to make sure that the contractors are not selected based only on the lowest bid. The selected contractor must have sufficient knowledge, technical competence, financial competence, and adequate skills to execute the project. Clients should not interfere frequently during the execution and keep making

major changes to the requirements. This can cause inordinate delays in the project. Clients should have the finances in time to pay the contractors after completion of a work. Therefore, clients should work closely with the financing bodies and institutions to release the payment on schedule, and clients must make quick decisions to solve any problem that arise during the execution.

While drawing the contract between the client and contractor, the consultant must include items such as duration of contract, mechanism to solve disputes, mechanism to assess the causes of delay, if there are any and risk man-agreement plans. Consultants should prepare and approve drawings on time. Consultants should monitor the work closely by making inspections at appropriate times.

Contractors must employed competent professional before take up the jobs, in which they do not have expertise. Contractors should have skill project and site professionals/mangers' for the ease implementation of work. Contractors should plan their work correctly and offer the full schedule to the developers and the contractors must make sure they have a far-reaching monetary support for the project.

Al-Momani (2000) research on Causes of delay in construction industry in Libya came out with the following recommendation to decrease causes of delay: contractors management team should rake actions to control causes within the planned element of the design and construction works, thus good practice in planning, scheduling, coordination, and the continuous of control procedures needs to be recognized. The developer should set in place risk management mechanism as an significant factors that will assistance to reduce delays in construction projects. Early correct forecasting should be considered to curb on necessary time loss. It is significant to improve the estimated activity period according to the actual skills levels, efficiency of work time, and avoid errors and misunderstanding.

Apolot et al. (2011) an investigation into the causes of delay and cost overrun in Uganda's public sector construction projects. They recommended that there should be: Improvement in project management team; Change from the traditional contract type to the design-build type; and improve cash flow on the part of the client so as to reduce payment delays.

Kikwasi, (2012) study on "causes and effects of delays and disruptions in construction projects in Tanzania" recommended that: Adequate construction budget must be available; timely issuing of information; finalization of design drawing before project commencement and project management skills should be the main focus of the parties in project procurement process. Bordat et al. (2004) said to achieve error free design entails: proper communication with the entire design professional, coordinating the entail design process is of utmost important thus, proper planning, giving sufficient time for rectification of errors, extensive investigation and reviews during design stage is all essential requirement to reduce construction delays.

Fugar and Agyakwah-Baah (2010) study on "causes of delay in construction project in Ghana" recommended the following solutions to causes of delay in Ghanaian construction: the recommendation comprises: lessen the delay in big construction project following particulars are very important. It's also suggest that seller must be give imbursement to contractor at time because it is liability of contractor to manage the economic record and due to which work growth is effective. For reducing delay in project modification during construction must reduce to bearest minimum. It is also important for contractors to increase this labour size as productivity increases. To reducing delay, managerial and technical staff should be acquired for site management and supervision. It is always important to include expert and experienced workforces for improvement of performance.

Based on Dayi (2010) study on "schedule delays analysis in construction projects" recommended that to minimize or avoid the impacts of the construction delay: design of the

project should be finalized with all details before tendering the work so as to avoid change orders by the owners. Owner should allocate sufficient time and adequate finances for the design stage of the project; Selection of the contractor should be done through a pre-qualification of the firms; Owners should mobilize all resources and get the necessary permissions before signing the contract; contract should include clauses of incentive for early completion; schedule should be prepared and agreed over by both the contractors and the consulting companies; contractor should employ qualified work teams and provide in-house worker training in order to improve managerial and technical skills; contractor should also have a project manager in his team to check the progress of work and ensure timely delivery of materials and last but most important issue is to establish a healthy communication between all parties in order to solve problems in a timely manner

Aiyetan et al. (2011) study on "system thinking approach to eliminate delays in building construction projects in South Africa". Compulsory inclusion of tertiary education programmes for all disciplines thus: quality management; operational planning; design management, and generic management should be practice.

At the tendering stage the following should be made part of the tender documents, including pre-tender programme; primary materials; method statement; site layout; subcontractor schedule; human resources schedule; plant and equipment schedule; quality plan, and work schedule.

The pre-qualification of suppliers is suggested. A brief description of requirements for consideration during the pre-qualification are assessing the past records of the suppliers; ascertaining the financial capability of supplies; ascertaining the educational qualification of suppliers regarding their materials performance knowledge, and owned assets, such as light delivery trucks. At the brief/design stage, attention should be paid to adequate briefing,

confirmation of client financial capability, and design quality assurance/constructability reviews.

At the construction stage, focus on adequate planning/resource management, work schedules, and monitoring of subcontractors' work, and prompt payment of interim certificates will contribute to eliminating delays in projects.

According to Haseeb et al. (2011) to decrease the delay in large construction project the following particulars are very significant: vendor must be give imbursement to contractor at time because it is liability of contractor to manage the economic record; to decrease delay in projects changes in drawings during construction should reduce; to reduce delay in project execution the contractor must have knowledge on resources strength and obtain up-to-date machinery, and/or try to obtain new equipment for construction. It is contractor liability to manage the capital resources throughout the project and use it appropriately to avoid cash flow problems.

A study on delay in Nigerian construction industry carried out by Kasimu and Usman (2013) suggested the solutions below: Risk management practices should be excellently used; there should be proper planning and proper payment from client. And a very good preparation of insurance claims and scheduling of programmes should be encouraged.

2.6.1 Summary of solutions to causes of delay

Related studies of the literature above on suggested solution of delay point to the fact that causes of delays in construction projects vary globally, this makes most important causes in Ghana in the perspective of contractors becomes important in solution to delay issues

Clients have to make sure that the contractors are not selected based only on the lowest bid; Clients should not interfere frequently during the execution and keep making major changes in the design; Clients should have the finances in time to pay the contractors after completion of a work; Clients must make quick decisions to solve any problem that arises during the

execution; Consultants should monitor the work closely by making inspections and correction at appropriate times; Contractors should not take up the job, in which they do not have sufficient expertise; Contractors should have able site-managers for the smooth execution of work; Contractors must make sure they have a sound financial backing; Initial proper planning should be considered to reduce or avoid on necessary delays; Change from the traditional contract type to the design-build type will save time and Good communication with the entire design team and integrating a design process and review on time.

CHAPTER THREE

METHODOLOGY

3.0: INTRODUCTION

This study adopted all appropriate mechanisms essential in achieving the aim and the outlined objectives. The scope of the research was limited to Financial Class A3,B3 and D3,K3 Road and Building contractors working for the MRH (Ministry of Roads and Highways) and MWRWH (Ministry of Water Resource, Works and Housing) in the Brong Ahafo region of Ghana. A mixture of primary and secondary data was used to identify the most important causes of delays in construction projects in Ghana.

3.1: RESEARCH APPROACH

Literature shows that similar studies undertaken by several researchers mostly adopted a quantitative approach, using structured survey questionnaires with a combination of open and close ended questions. A study by Sambasivan and Soon, (2007) used quantitative approach and developed open and close ended questionnaire to assess the perceptions of clients, consultants, and contractors on the relative importance of causes and effects of delay in Malaysian construction industry. Their questionnaire was divided into three parts. The first part requested background information about the respondents; the second part focused on causes of construction delay and third part focused on the effects of construction delay in Malaysian construction industry. Apolot et al. (2011) used a structured survey questionnaire and a case study of Civil Aviation Authority to validate the findings from the survey. The questionnaire was compiled based on the list of causes identified from literature and pilot study. The piloting was used to improve the wording and increase the reliability of the questions. In their research the respondents were requested to give their opinion on the frequency and severity of each of the twenty two (22) factors using a 4 - point likert scale instead of the standard five point scale. The neutral point (where the respondents declare no

opinion on the matter) was eliminated from the five-point scales so as to obtain the respondent's views on the subject (Amin, 2005). This is because the respondents who were chosen were assumed to be knowledgeable on the subject matter. Alzan et al. (2011) research took a quantitative approach with structured open and close ended questionnaires. The questionnaires were administered by contractors and sub- contractors in Klang valley, Kuala Lumpur, Selangor and its suburbs. The study was limited to contractors and sub-contractors since this research aims to study the perception of contractors in commercial projects delay. Assaf and Al-Hejji, (2006) research methodology contained Seventy-three (73) causes of delay through literature review and also discussion with some parties involved in construction industry. A questionnaire was developed in order to evaluate the frequency of occurrence, severity and importance of the identified causes of delay. The questionnaire was divided into two main parts. Part I was related to general information for both the company and respondent and part II was on the cause of delay with respect to frequency of occurrence, severity and importance. Both contractors and consultants were requested to answer questions on four-point scale. .

Fugar and Agyakwah-Baah, (2010) study was of two stages, the first phase was on identification of thirty-two (32) causes of delay from literature and development of questionnaire incorporating the 32 causes of delay identified for data collection. Their questionnaire was organised in the form of an importance scale. Respondents, were asked to indicate by ticking a column the relative importance of each of the causes of construction delay (in terms of 4 = 'very important', 3 = 'important', 2 ='somewhat important', 1 = 'not important'). The second phase was non-structured interviews of 15 key players involved in the implementation process selected by a non-probabilistic snow ball technique. Kikwasi (2012) used quantitative approach which was descriptive and developed questionnaire to obtain views from clients, consulting firms, regulatory boards and construction firms in

regard to causes and effects of delays and disruptions of construction projects in Tanzania. A research carried out on "Causes of construction cost and time overruns: the 2010 FIFA World Cup stadia in South Africa" by Baloyi and Bekker, (2011), in order to conduct the survey, a detailed questionnaire was developed. They said the main purpose of the questionnaire was to assess the perception of respondents regarding the factors that cause project delays and cost overruns. The questionnaire consisted of 18 potential factors causing cost overruns and 34 potential factors causing delays, to be ranked by respondents. In order to minimize potential overlaps, the 52 factors were carefully described. This research adopted quantitative approach with descriptive design. Other researchers like Albogamy et al (2012); Alaghbari et al. (2007), Long et al (2004), and Abdul-Rahman et al. (2006) all used quantitative approach with structured survey questionnaires to obtain respondents responses for their research.

Based on methods used by the related research above, this study adopted a quantitative approach with structured survey of open and close ended questionnaires. The questionnaires were designed in three parts: part I focused on the respondents personnel information; part II emphasized on the most important causes of delays while part III concentrated on solutions to the identified delays in the construction projects in Ghana. In the field survey, the respondents were asked to indicate the level of importance of each causes and solutions using five-point likert scale ranging from 1 (not important) to 5 (extremely important).

3.2: POPULATION AND SAMPLING

According to Kikwasi, (2012) in his quest to carry out research on "Causes and effects of delays and disruptions in construction projects in Tanzania", he came out with a sample population size of sixty (60) comprising 33 construction firms, 10 quantity surveying, 10 architectural consulting firms, 5 clients and 2 statutory bodies. The author used two sampling procedures due to the nature of respondents to be involved in the study. He used random sampling to select consultants and contractors. According to Kombo and Tromp (2006),

random sampling is the probability whereby people, place or things are randomly selected. Construction firms and quantity surveyors were selected through random sampling. While Clients and Regulatory bodies were selected using purposive sampling. In as much as purposive sampling is a nonprobability selection, according to Walliman (2005) purposive sampling is a useful sampling method which allows a researcher to get information from a sample of the population that one thinks knows most about the subject matter. The sampling method used by Sambasivan and Soon, (2007) was convenience and snowball sampling. This sampling comes under the class of non-probability sampling techniques. As the name implies, sample elements are identified by convenience (friends) and through referral networks. A total of two hundred (200) construction professionals were selected. This method of sampling is preferred when it is difficult to get response from sample elements selected at random. The author distributed the questionnaires through friends working in Public Works Department of Malaysia, developers, consultants and construction firms. This sampling method enabled them to obtain a large number of completed questionnaires quickly and economically. In Alzan et al. (2011) study 100 contractors registered with the Construction Industry Development Board (CIRB) Grade 7 with unlimited tendering capacity and Contractors Service Center Grade 'A' with project cost above RM 10million were selected. Lastly, projects completed between 2000 -2010 were the target.

A research carried out by Assaf and Al-Hajji, (2006) used a simple random sampling to select 138 constructions professional and clients to participants from an available list. The results obtained were 66 contractors, 51consultants and 27 clients. The questionnaires administered by respondents and return were 23 contractors, 19 consultants and 15 owners. Fugar and Agyakwah-Baah, (2010) search on "causes of delay in building construction projects in Ghana" selected a population sample of One hundred and sixty five (165) comprising clients 55, contractors 55 and consultants 55 base on convenience and availability

sampling . A research carried out on “Causes of construction cost and time overruns: the 2010 FIFA World Cup stadia in South Africa” by Baloyi and Bekker (2011) a total of 60 questionnaires were distributed to consultants (24), contractors (20) and clients (16) involved in the ten 2010 World Cup construction sites. The sampling method used is commonly referred to as convenience or snowball sampling (Sambasivan & Soon, 2007). This type of sampling falls under the category of non-probability techniques and, as the name implies, sample elements are identified by convenience (friends, colleagues and professional contacts) and referral networks.

The population for this study was obtained from sixteen (16) Municipals and Districts Assemblies, Head offices of Ghana Highways Authority (GHA), Urban Roads Department and Feeder Roads Department in the Brong Ahafo regionals capital, Sunyani. Registered contractors data obtained from various contract registers in the above mentioned districts and departments as at May (2014) are listed in the Table 2.1 below.

Table 2.1: Population and sampling size

No.	Districts	Total No. of registered Contractors	Total No. of D3K3 Contractors	Total Percentage D3K3
1	Asunafo North	41	33	80.49
2	Asunafo South	36	30	83.33
3	Asutifi North	61	34	87.93
4	Berekum	33	29	87.88
5	Dormaa Central	32	24	75
6	Jaman South	15	14	93.99
7	Kintampo North	31	26	76.47
8	Techiman	59	48	81.36
9	Wenchi	34	26	76.47
10	Sunyani Municipal	72	59	81.94
11	Jaman North	21	16	76.19
12	Tano South	18	14	77.78
13	Tano North	17	12	70.58
14	Pru	20	15	75
15	Nkoranza South	18	13	72.22
16	Asutifi South	23	16	69.57
No.	**Departments**	**Total No. of registered Contractors**	**Total No. of A3B3 Contractors**	**Total Percentage A3B3**
1	Ghana Highway Authority	31	19	61.29
2	Department of Feeder Roads	59	51	86.44
3	Department of Urban Roads	19	12	63.16

Source: Field study 2014

In gathering the data above it was observed that, contractors sometimes register as many districts as they desire to increase their chances of getting jobs in those districts. My conversation with the Managing Director of Messer's Samotrust Company Limited and Messer's Sabonsu Construction Works confirmed that, they have registered twelve (12) and ten (10) municipals/districts respectively out of the sixteen (16) districts listed above. To avoid duplication of contractors' working in the MMDAS/department collation, the district/department with the highest population size (Sunyani Municipal and Department of feeder roads) were selected with the population size of 59 and 51 respectively, totalling 110. The reason is that, a contractor can register once in each particular district/department. Moreover the study was limited to D3K3 and A3B3 contractors because the tabular data above indicates that contractors with Financial Class D3K3 and A3B3 registered and working in Brong Ahafo form the majority. This makes D3K3and A3B3 contractors' appropriate scope for the study. Kish (1965) formula was used to determine the sample size from the population. The sample size determination was thus calculated as follows based on the Kish (1965) formula:

3.2.1: D3K3 Contractors

$n = n'/(1 + n'/N)$

Where n = Sample Size

$n' = S^2/V^2$

N = Population size

V = Standard error of sampling distribution (5percent)

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

P = Proportion of population elements that belong to the defined class (50percent) was applied for the determination of the sample size

Using N = 59, V = 0.05 and P = 0.50

$S^2 = P(1-P) = 0.50(1-0.50) = 0.25$,

$n' = S^2/V^2 = 0.25/0.05^2 = 100$ and

$n = n'/(1 + n'/N) = 100/(1 + 100/59) = 37.11 \approx$ **37 nr**.

This makes the number of D3K3 contractors sampling for the study to be 37.

3.2.2: A3B3 Contractors

$n = n'/(1 + n'/N)$

where n = Sample Size

$n' = S^2/V^2$

N = Population size

V = Standard error of sampling distribution (5percent)

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

P = Proportion of population elements that belong to the defined class (50percent) was applied for the determination of the sample size

Using N = 51, V = 0.05 and P = 0.50

$S^2 = P(1-P) = 0.50(1-0.50) = 0.25$,

$n' = S^2/V^2 = 0.25/0.05^2 = 100$ and

$n = n'/(1 + n'/N) = 100/(1 + 100/51) = 33.77 \approx$ **34 nr**.

This makes the number of **A3B3** contractors sampling for the study to be 34, totaling **71** contractors for this study. Quota sampling technique was used, since the Kish (1965) formula was used to determine the proportion of D3K3 and A3B3 contractors for the study. Quota sampling technique was used to ensure equal or proportionate representation of subjects.

3.3 SOURCES OF DATA

Among the available methods in collecting data Kikwasi, (2012) adopted two methods; these are literature and questionnaires. He reviews literature to establish what others have documented on the subject matter. He gathered other useful information from seminar and workshop papers, journal papers and internet sources. The researcher further used questionnaires to gather information from respondents for the study. Sambasivan and Soon, (2007) obtained data from literature on previous related studies, journals and dissemination of questionnaires to friends working in Public Works Department of Malaysia, private developers, consultants and construction firms. Apolot et al, (2011) compiled data from literature reviewed, discussion with contractors, government ministry officials, and consultants working on public projects, and on personal experience with public construction projects. Additional data were obtained through administering of questionnaire and a case study of Civil Aviation Authority (CCA) was used to validate the finding from the survey. The survey was carried out among corporate members of Uganda Society of Architects (USA), corporate members of Uganda Institution of Professional Engineers (UIPE) and registered Quantity Surveyors who have participated in the implementation phase of construction projects in Uganda's public sector. In Alzan et al, (2011) study used sources such as academic research journals, dissertations, textbooks, articles and the internet. Questionnaires were also used to take information contractors registered with the Construction Industry Development Board (CIRB) Grade 7 with unlimited tendering capacity

and Contractors Service Center Grade 'A' with project cost above RM 10million. In Assaf and Al-Hajji, (2006) study, source data were obtained through review of previous related studies and dissemination of survey questionnaires to; contractors, consultants and Clients. The contractors surveyed are categorized as Grade 2 or above and should have an average of experience of about 23 years, while, participated consultants should have an average of about 21 years of experience. Fugar and Agyakwah-Baah, (2010) research data collection process involved two stages. The first stage consisted of literature search for information on the causes of delay in other countries and non-structured interviews of 15 key players involved in the implementation process selected by a non-probabilistic snow ball technique. They said the purpose of interviewing the key players was essentially to validate a preliminary set of construction delay causes gleaned from the literature and to determine from their experience other factors which cause construction delay in Ghana. To ensure a balanced view, their interviewees consisted of 5 each of contractors, client's representatives and consultants.

In this study data were gathered from literature of related studies, journal papers, textbooks, internet (world-wide-web), personnel interaction with contractors and construction professionals in the Ministry of Roads and Highways (MHR) and Ministry of Water Resource, Works and Housing (MWRWH). Additional information will be taken from Road and Building contractors with Financial Class A3B3 and D3K3 respectively. These contractors should be working in the Brong Ahafo region for Municipal and District Assemblies, Department of Feeder Roads, Department of Urban Roads and Highways Authority.

3.4: COLLECTION OF DATA

In the research carried out by Sambasivan and Soon, (2007) two hundred (200) questionnaires were distributed to potential respondents. One hundred (100) to clients (50 sets to Public Works Department of Malaysia and 50 sets to private developers), fifty (50) to consultants and fifty (50) sets to public contractors. Out of 200 questionnaires, 150 sets representing (75%) were retrieved and used for the data analyses, sixty seven (67) from clients, forty eight (48) from consultants and thirty five (35) from contractors. In Alzan et al, (2011) study, One hundred (100) sets of questionnaires were distributed to contractors and sub-contractors by email, fax and direct meeting. Out of these 100 set questionnaires, 39 responses were received while only 36 of the questionnaires are valid. According to Gillham, (2000) 30% response rate is require to produce a reliable result, while in this study; the response rate of 39% was received, with a useable response rate of 36%. A total of 165 questionnaires were distributed to respondents in the Greater Accra Region of Ghana where the concentration of contractors and consultants is highest. The questionnaires were personally delivered to the respondents by the researchers who also went back to collect them at appointed times. The collection of data took 4 weeks. At end of the period, 130 questionnaires (79%) representing clients 37, contractors 39 and consultants 54 which is also 67%, 71% and 79% respectively were retrieved. The author said convenience or availability sampling approach was used in the selection of respondents due to unavailability of data. Gabor (1993) and Baley (1994) describe this type of sampling as one where the researcher uses cases that are most convenient and available. They said the disadvantage of this approach is its tremendous potential for bias (Frey et al., 1991). They further said, considering that this is a preliminary study, convenience sampling was considered appropriate. Kikwasi, (2012) out of his sample size of 60 respondents comprising 33 construction firms, 10 quantity surveying, 10 architectural consulting firms, 5 clients and 2

statutory bodies. Forty three 43out of 60 questionnaires were retrieved and 40 were found fairly filled for the analysis.

In Baloyi and Bekker, (2011) out of 60 questionnaires distributed 22 (36%) responses were received from six stadia construction professionals. Out of the 22 returned questionnaires, 5 (22.7%) were from clients, 3 (13.6%) from contractors and 14 (63.6%) from consultants. Soccer City had the highest response rate (31.8%) and Loftus the lowest (9%). Although the responses from clients and contractors were fairly low, the structuring of the questions minimized subjectivity. The low response rate made it impossible to conclude statistically significant findings. However, some indicative trends could be observed.

In this study a total of seventy (71) structured survey open and close ended questionnaires were distributed to 37 Building and 34 Road contractors of Financial Class D3K3 and A3B3 working in the Brong Ahafo region of Ghana. The questionnaires required the respondents to rank a set of responses. The first set of questions sought to obtain general information from respondents, the second set required to obtain information on the most important causes of delay while the third section sought to identify solution to the causes of delay. The questions were ranked on a likert scale of 1-5 to indicate the extent of importance (one (1) not important to five (5) extreme important). The questionnaires were delivered to the contractors and their representatives personally by the researcher. The questionnaires were collected from respondents within three (3) weeks. Out of the seventy one (71) questionnaires distributed, sixty seven (67) were retrieved, with sixty four (64) out of that number being valid for analysis after the data was processed. The sixty four (64) valid questionnaires retrieved comprised: (32) each of D3K3 and A3B3 contractors.

3.5 DATA ANALYSIS

Previous studies employed different methods to analyse their data. The commonest among these are Relative importance index (RII); Relative importance weight; Mean score and Standard deviation; Rank correlation coefficient; Frequency index and Severity index etc.

A study conducted by Sambasivan and Soon, (2007) "Causes and Effects of delay in Malaysian Construction Industry" used the relative importance index method to determine the relative importance of the various causes and effects of delays. Each individual causes RII perceived by all respondents were used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Malaysian construction industry. The same procedure was adopted for ranking the effects. These rankings made it possible to cross compare the relative importance of the items as perceived by the three groups of respondents.

In another study a researcher used Statistical Package for the Social Sciences (SPSS) 10.0 was used to compute the alpha for all the four set of variables. They include: frequency of occurrence factor in causing delays; frequency of occurrence factor in causing cost overruns; impact of factors on project time and impact of factors on projects cost. The entire set of variables (88 items) in the questionnaire was also tested. The author further analyzed the data to determine their frequency of occurrence, severity and importance index. (Apolot et al., 2011). Data collected by Assaf and Al-Hejji, (2006) were analyzed through the following statistical techniques and indices: Frequency index (A formula used to rank causes of delay based on frequency of occurrence as identified by the participants). Severity index: (A formula is used to rank causes of delay based on severity as indicated by the participants). Importance index: (The importance index of each cause is calculated as a function of both frequency and severity indices). Kikwasi, (2012) analysed his data by calculating frequencies

and Relative importance index of all the variables. The researcher said he combined all groups of respondents (clients, consultants, contractors and regulatory boards) in order to obtain significant results. Fugar and Agyakwah-Baah (2010) first used relative important index (RII) to establish the relative importance of the various factors identified as responsible for construction delay. The score for each factor was calculated by summing up the scores given to it by the respondents. The researcher further used spearman's rank collection coefficient (ρ) to show the degree of agreement. The relative importance index for all the delay factors and groups was calculated. The group index is the average of relative importance index of the delay factors in each group. The Spearman's rank correlation coefficient (ρ) was used to show the degree of agreement between the rankings of any two parties.

3.5.1 Analyses of dependent variables

In the study, collected data was analysed for meaningful discussions by the use of the Statistical Product for Social Scientists (SPSS) data analysis tool, in conjunction with MS Excel where required. Two statistical analyses were undertaken, namely Relative Importance Index and Factor Analysis. Relative importance index was used to identify the most important causes of delay in construction projects out of twenty variables and Factor analysis was used in establishing which of the variables could be measuring the same underlying effect and also reduce the dependent variables to a manageable size.

3.5.1.1: Relative important of dependent variable.

To determine factors that are most important among the set variables, can best be determined by the use of Relative Important index. In this study, twenty three factors on causes of delay in construction projects were listed with a likert scale of one to five (1-5). The score for each factor was calculated by summing up the scores given to it by the respondents.

The relative importance index of each factor was measured using the formula below:

Relative importance index (RII) = $\Sigma WA\times$, where

W is the weight given to each factor by the respondent and ranges from 1 to 5

A is the highest weight-5

N= the total number of respondents = 64 (D3 and A3 contractors).

ΣW = the summation of the weighting given to each factor

W = $\Sigma[(f_1 x\ n_1)+(f_2 x\ n_2)+(f_3 x\ n_3)+\ldots\ldots\ldots+(fn x\ nn)]$ where

fn = score ranking nn = corresponding number of responses.

3.5.1.2: Factor Analyses of Dependent Variables

Due to the relatively large number of the dependent variables (i.e. solution to causes of delay) involved in the study, it was deemed necessary to use factor analysis to establish which of the variables could be measuring aspects of the same underlying dimensions. Factor analysis is useful for finding clusters of related variables and thus ideal for reducing a large number of variables into a more easily understood framework (Ahadzie, 2007). During factor extraction, the shared variance of a variable is partitioned from its unique variance and error variance to reveal the underlying factor structure and hence only shared variance appears in the solution. Factor analysis relies on the correlation matrix of the variables involved and the correlations usually need a large sample size before they are stabilized. The reliability of factor analysis is reliant on the size of the sample. A minimum of ten observations per variable is necessary to avoid computational difficulties (Decoster, 1998).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0: INTRODUCTION

This chapter gives a comprehensive and analytical discussion of the result of the study in the form of tables and graphs. This is a collected data from the questionnaires administered from the field. The initial aspect of the result deals with general organisational information which comprises location of company, types of works, form of establishment and work experience. The subsequent section comprises causes of delay and solution. The analytical tools used for the analysis consist of basic frequency for the organisational information; relative importance index to identify the most important causes of delay and factor analysis to develop solution to the most important causes of delay.

4.2: GENERAL ORGANISATIONAL INFORMATION

Figure 4.2.1 to 4.2.4 below shows analyses of the general organisational information gathered from the respondents.

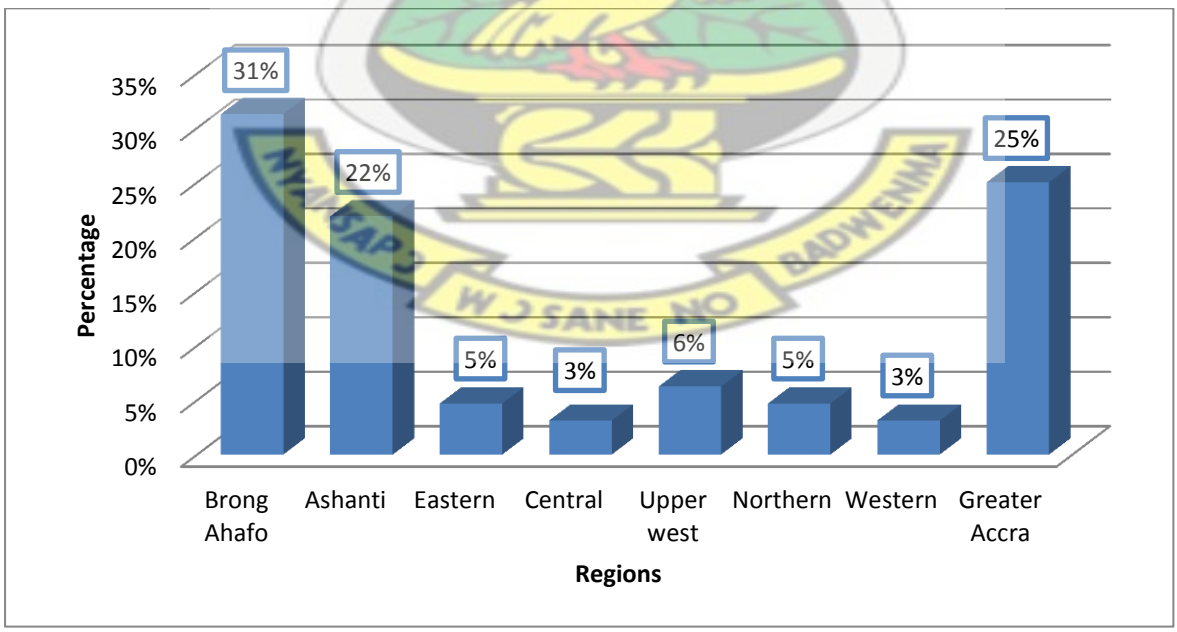

Figure 4.1: Location of company/firms

Source: Field Study, 2014

Figure 4.2.1 indicates that the study covered contractors' companies/firms located in 8 out of 10 regions in Ghana. This means the study in respect of contractors located is widespread.

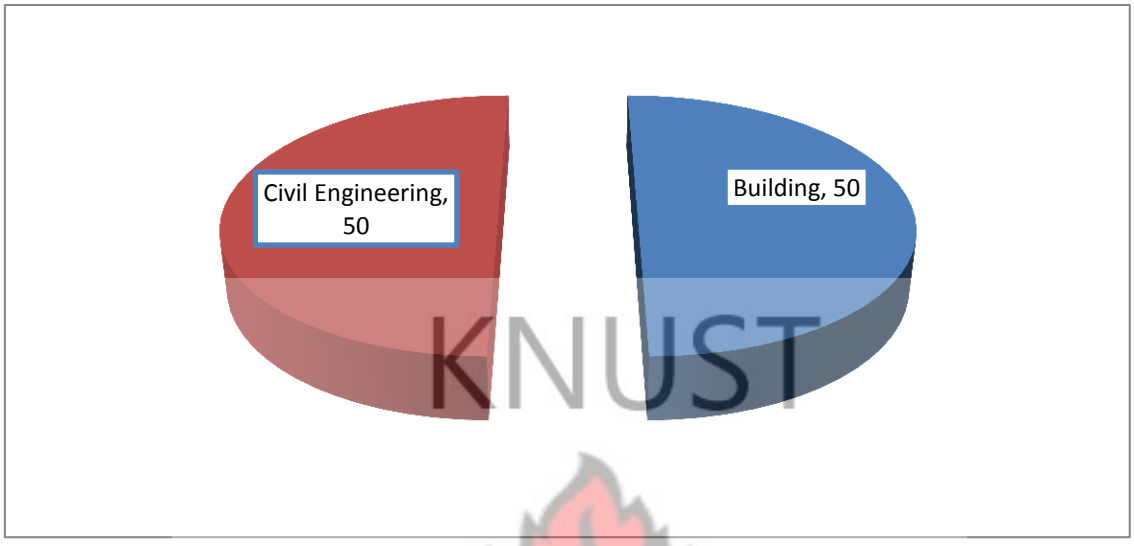

Figure 4.2: Type of works executed by contractors'

Source: Field Study, 2014

Figure 4.2.2 shows that 50 percent of the respondents carry out civil engineering works and while 50 percent also carry out building construction projects. This gave a fair representation of the type of contractors working in the region.

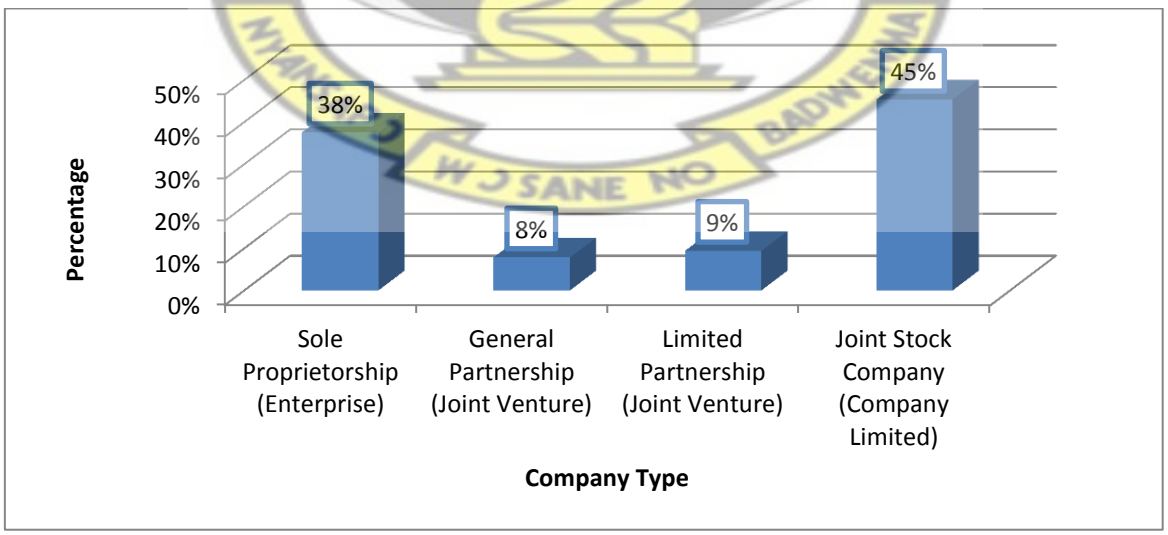

Figure 4.3: Form of Establishment

Source: Field Study, 2014

Majority of the respondents form of establishment was joint stock company (company limited) representing 45 percent. Sole proprietorship form of establishment represented 38 percent of the respondents. General partnership and limited partnership represent 8 percent and 9 percent respectively. The bring to conclusion that in this study the main forms of establishment of the organisations were Joint Stock Company and sole proprietorship as observed from Figure 4.2.3.

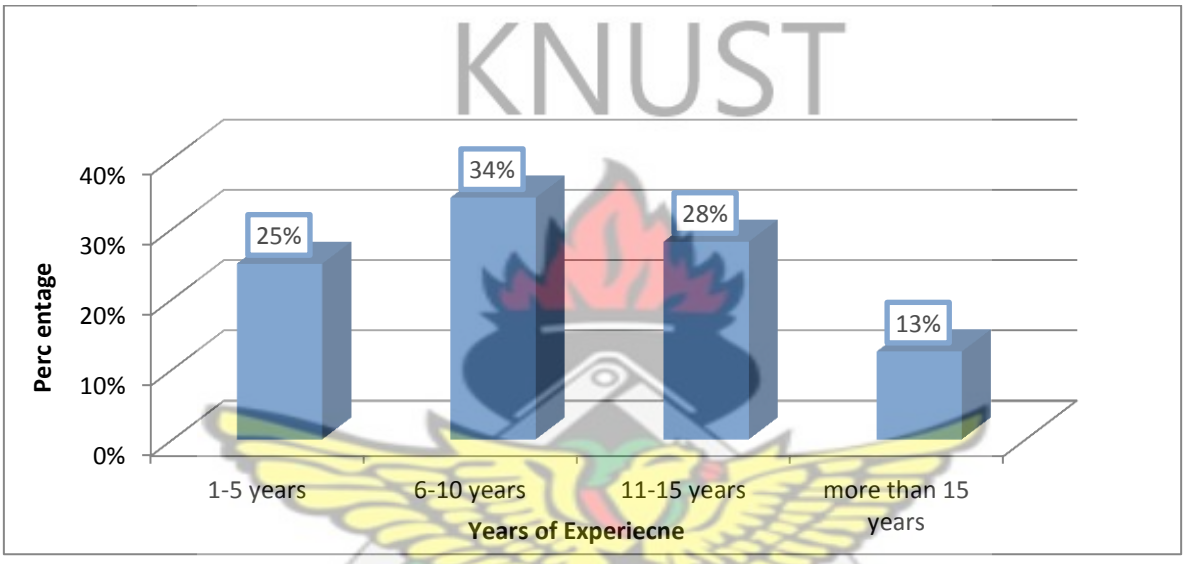

Figure 4.4: Working Experience of respondent Contractors

Source: Field Study, 2014

Figure 4.2.4 indicates that respondents have had enough working experience in both building and civil engineering. It was observed that, age groups were fairly distributed. The highest work experience was between 6-10 years representing 34 percent, 28 percent had worked for 11-15 years, 13 percent had worked for more than 15 years', and finally 25 percent had worked for 1-5 years. At least 75 percent of the respondents had worked for 6 years and above. This showed that respondents have had enough working experience in the construction company.

4.3: IDENTIFYING THE MOST IMPORTANT CAUSES OF DELAY

Respondents were asked to rank the factors that cause delays and how each importantly contributes to the delays. The factors that cause delay were identified to be twenty-three which were observed to be significant. Relative importance index was run to check the importance of the factors to cause delay. Relative index of 70 percent and above was considered to be highly significant. This means that the first twelve rankings were highly significant. As observed from Table 4.1, the first two factors, thus, clients inadequate financial resources with relative index of 96 percent and delays in honouring payment certificates for work done with index of 93 percent were the most important causes of delay. By ranking, it meant all the respondents ranked these two factors as extremely important causes of delay. The third and fourth factors were equally extremely important, thus, underestimation of the project duration with 83 percent and poor communication between contracting parties with index of 82 percent. Other causes of delay factors are ranked in table 4.1 below.

Table 4.1: Relative important index of causes of delay

Causes of Delay	Valid	Sum	RII	Ranking
Clients inadequate financial resources	64	307	0.960	1
Delays in honouring payment certificates for work done	64	298	0.930	2
Underestimation of the project duration	64	264	0.830	3
Poor communication between contracting parties	64	261	0.820	4
Complexity, difficulties in accessing bank credit (client)	64	253	0.790	5
Change orders during construction	64	249	0.780	6
Delays in sub-contractors work	64	248	0.780	7
Bureaucracy in decision making	64	247	0.770	8
Contractors improper planning during construction	64	246	0.770	9
Delay in instructions from consultants	64	245	0.770	10
Errors in design and specification	64	241	0.750	11
Underestimation of the project costs	64	238	0.740	12
Poor supervision of work on site	64	220	0.690	13
Contractors poor sites management	64	218	0.680	14
Building approval delays by statutory authorities	64	212	0.660	15
Complexity, difficulties in accessing bank credit (contractors)	64	210	0.660	16
Material procurement difficulties	64	208	0.650	17
Foundation conditions encountered on site	64	208	0.650	18
Mistake in soil investigation	64	208	0.650	19
Unfavourable site conditions	64	196	0.610	20
Bad weather condition	64	184	0.580	21
Material price escalations	64	183	0.570	22
Lack of complete documentations before commencement	64	165	0.520	23

Source: Field Study, 2014

4.3.1: Discussion of results on cause of delay

Brief discussion on the extremely important causes of delay in construction projects in the descending ranking order:

4.3.1.1: Client inadequate financial resource

Client inadequate financial resource with relative index of 0.960 was ranked first as the extremely important cause of delay by respondents. This can lead to delay in honouring

payment certificates for work done which was ranked second with an index of 0.930 as also an important cause of delay. A study conducted by Fugar and Agyakwaah-Baah (2010) found these problem as the main factors that cause delay in building project in Ghana. Delays of payment may result in cost overruns hence adequate funding prior to the award of contract is necessary to ensure that project cost remains within budget. Long delays as a result of inadequate funding in inflationary periods increase cost overruns extremely (Arditi et al., 1985). To curb these challenges, contracting parties most especially the client should address the challenges related to funding before project commencement and prepare a good payment schedule to ensure that payments are honoured on time.

4.3.1.2: Underestimation of the project duration

Underestimation of the project duration was ranked third with relative index of 0.830. To ensure that costs are kept within budget, historical data which affect construction costs such as size of project, proper scope definition, etc. must be kept. A consistent mistake is that adjustment for myriad factors are not made (Bill et al., 2006). The basis of any cost estimate is to determine the project scope, design and specifications (Beattie, 2002). The inaccuracy of any estimate in the early stages of the project is mostly dependent on clear definition of project scope (Sawczuk, 1996). It is however, not surprising proper planning and clear definition of project scope and specifications was ranked highest among the mitigating ways.

4.3.1.3: Poor communication between contracting parties

Communication between contracting parties was ranked fourth with 82 percent, since information flow between contracting parties depends on communication. This means establishment clear communication channels is necessary so that corrective cost control measures can be implemented by parties in charge (Oosthuizen et al., 1998). This means poor communication among stakeholders could lead to delay.

4.3.1.4: Complexity in accessing bank credit

Complexity in accessing bank credit was ranked fifth with index of 0.780. Every project requires adequate funding for successful execution and completion. It is complex to secure funding for construction project since the construction industry neither new nor unique globally faced cost overrun problems. A study by Mbachu and Nkado (2004) revealed that globally, the construction industry is plagued with cost overruns in project delivery which makes it unattractive for investors. The perception that cost overruns in public and private construction projects are the result of scandalous acts (Oberndofor, 1994) worsens the image of the industry.

Factors six to ten are all important causes of delay that need remedy to reduce its effect in project execution. Human resources schedule, plant and equipment schedule; quality plan, and work schedule plan all put together will reduce delays to bearest minimum.

4.4: SOLUTION TO CAUSES OF DELAY

Respondents were asked to rank the factors on solution to causes of delay and how each will help solve delay issues. The factors on solutions to the causes of delay identified were twenty-three. Table 4.2 below shows detailed factor analysis on the grouping of headings.

Table 4.2: Components and Loadings - Solution of Groups of Delay Factors

NO.	GROUP	LOADINGS	COMPONENT
1	**PROPER PLANNING AND CONTROLLING**		**1**
	Human resources schedule, plant and equipment schedule; quality plan, and work schedule should be checked at tender stage	0.662	
	At the tendering stage, strict adherence of the general tender information must comply	0.538	
	Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes	0.813	
	Design quality assurance reviews at the design stage	0.838	
	Contractors must plan their work properly and provide the entire schedule to the clients	0.645	
	At the design stage, adequate briefing, confirmation of client	0.793	
	At the construction stage, adequate planning/resource management, work schedules, and monitoring	0.583	
	Contractors must have knowledge about their resources strength and obtain up to date machinery	0.563	
2	**PROPER FINANCIAL MANAGEMENT**		**2**
	Clients should have the finances in time to pay the contractors after completion of a work	0.869	
	Contractors must make sure they have a sound financial backing	0.477	
	Clients have to make sure that the contractors are not selected based only on the lowest bid	0.891	
	The owners should include mobilize all resources and get the necessary permissions before signing the contract	0.855	
	Contractors should not take up the job, in which they do not have sufficient expertise	0.813	
	Contractors should have able site-managers for the smooth execution of work.	0.595	
3	**CONTRACTING RELATIONSHIP**		**3**
	Good communication with the entire design team and integrating a design process and review on time	0.680	
	Clients must make quick decisions to solve any problem that arises during the execution	0.574	
	Consultants should monitor the work closely by making inspections and corrections at appropriate times	0.679	
	The contract should include clauses of incentive for early completion	0.789	
	Consultants should prepare and approve drawings on time	0.756	
4	**DESIGN CHANGES**		**4**
	Clients should not interfere frequently during the execution and keep making major changes in the design	0.921	
	Initial proper planning should be considered to reduce or avoid on necessary delays	0.788	
	Ascertain the educational qualification of suppliers regarding their materials performance knowledge	0.842	
	Change from the traditional contract type of the design-build type will safe time	0.724	

Source: Field Work 2014

It was observed from Table 4.2 that there was significant inter-correlation among the variables. Again, Table A.3 in the appendix shows high extraction which was indication that the extracted components represent the variables (factors) well. All the extractions are high showing that variance in each variable accounted for by the components are very high. Hence, the data was adequate and appropriate for factor analysis.

Table 4.3: KMO and Bartlett's Test

Solution to Delay

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.515
Bartlett's Test of Sphericity	Approx. Chi-Square	1246
	df	253
	Sig.	0.000

Source: Field Study, 2014

Table 4.4 denotes percentage of the variance that is accounted for by each component to the total variance in all of the variables. Four components were extracted accounting for 81 percent with19 percent lost.

Table 4.4: Total Variance Explained - solution to causes of delay

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.796	7.807	65.037	1.796	7.807	65.037	2.299	9.994	56.96
2	1.456	6.33	71.367	1.456	6.33	71.367	1.911	8.308	65.268
3	1.225	5.324	76.692	1.225	5.324	76.692	1.851	8.05	73.318
4	1.011	4.398	81.089	1.011	4.398	81.089	1.787	7.771	81.089

Source: Field Study, 2014

4.4.1: Discussion of results on solutions to causes of delay

Brief discussion on the extremely important causes of delay in construction projects in the descending ranking order:

Table 4.2 depict factor analysis on solution to causes of delay in construction project. It comprises of; planning and controlling, financial challenges, contractual relationship and design changes.

4.4.1.1: Component 1: Proper Planning and Controlling

The eight extracted success criteria for component 1 were *Human resources schedule, plant and equipment schedule; quality plan, and work schedule should be checked at tender stage* (0.662), *At the tendering stage, strict adherence of the general tender information must comply* (0.538), *Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes* (0.813), *Design quality assurance reviews at the design stage* (0.838), *Contractors must plan their work properly and provide the entire schedule to the clients* (0.645), *At the design stage, adequate briefing, confirmation of client* (0.793) , *At the construction stage, adequate planning/resource management, work schedules, and monitoring* (0.583) and *Contractors must have knowledge about their resources strength and obtain up to date machinery* (0.563). The figures in parenthesis indicate the respective factor loadings. These variables were named as proper planning and controlling. According to Sambasivan and Soon (2007) local contractors often fail to come out with applied and practicable ‘‘work program’’ at the initial planning stage. The failure is interrelated with lack of systematic site management and inadequate contractor’s experience towards the projects. The consultant only checks and reviews the work program submitted by the contractors based on experience and intuitive judgment. Improper planning at the initial stages of a project manifests throughout the project and causes delays at various stages.

4.4.1.2: Component 2: Proper Financial Management

Clients should have the finances in time to pay the contractors after completion of a work (0.869), *Contractors must make sure they have a sound financial backing* (0.477), *Clients have to make sure that the contractors are not selected based only on the lowest bid* (0.891), *The owners should include mobilize all resources and get the necessary permissions before signing the contract* (0.855), Contractors should not take up the job, in which they do not have sufficient expertise (0.813), *and Contractors should have able site-managers for the smooth execution of work* (0.595) were the factors under component two. Mansfield et al. (1994) who found that delay in payment from the client would eventually cause financial difficulties to the contractor. In the study by Odeh and Battaineh (2002), late payment was the second highest factor contributing to delay, ranked by consultants. To reduce these problems require clients initial proper planning, schedule and proper budgeting that include cash outflow to ensure that payments are honoured on time.

4.4.1.3: Component 3: Contracting Relationship

Component 3 was labeled contracting relationship and consists of *good communication with the entire design team and integrating a design process and review on time* (0.680), *Clients must make quick decisions to solve any problem that arises during the execution* (0.574), *Consultants should monitor the work closely by making inspections and corrections at appropriate times* (0.679), *The contract should include clauses of incentive for early completion* (0.789), and *Consultants should prepare and approve drawings on time* (0.756). A study by Sambasivan and Soon (2007) on causes and effects of delay came out that communication between the parties is very crucial for the success of the project. Project Management User's Guide (2005) mentioned that poor communication among stakeholders has the tendency to cause cost overruns. For this reason, proper communication channels between the various parties must be established during the planning stage. Any problem with

communication can lead to severe misunderstanding and therefore, delays in the execution of the project.

4.4.1. 4: Component 4: Design Changes

The fourth principal component in table 4.2 reported the factors loading as *Clients should not interfere frequently during the execution and keep making major changes in the design* (0.921), *Initial proper planning should be considered to reduce or avoid on necessary* delays (0.788), *Ascertain the educational qualification of suppliers regarding their materials performance knowledge* (0.842), and *Change from the traditional contract type of the design-build type will safe time* (0.724). Changes in drawings and delay in instruction are call causes of delay (Ahmed *et al*, 2002), Kikwasi (2012) study reveal that client variation is one of the predominant cause of delay. Changes and variation can reduce when adequate time is devoted during pre-contract stage for proper designing and documentation. Adequate proper briefing to client before final design will help solve the problem. Engagement of competent person will also help to reduce errors and faulty design.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.0: INTRODUCTION

Following the literature review and the research data analyzed in the previous chapters, this chapter summarizes the main findings and the emerging issues from the study. On the basis of these findings, conclusion is drawn and some recommendations have been made as some possible actions that can help manage the emerging issues. The findings have been classified under the study objectives which include:

1. To identify the most important causes of delay from the perspective of small scale Ghanaian contractors and
2. To identify solutions to causes of delay in construction project.

5.1: CONCLUSIONS

This study on key causes and solution to construction projects delays, target and seek views of Ghanaian contractors/firms of Financial Class D3,K3 and A3,B3 working on Buildings and Roads in the Municipal and District Assemblies, the Ghana Highway Authority and Department of Feeder Roads all in the Brong Ahafo region. In determining the most important causes of delay in construction projects, twenty three (23) factors each was identified for study objectives 1 and 2, after administering and analyzing data gathered from questionnaire. The objective 1 factor were found to have contributed to causes of delay in construction projects while objective 2 factors recommended solution to the causes.

5.1.1: Identification of the most important causes of delay from Ghanaian contractors

Respondents were asked to identify and rank the causes of delays based on their importance. Relative importance index was run to see how important each causes of delay was in relation to the other. The study revealed that the most important causes of delay from the perspective of Ghanaian contractors are:

1. Client's inadequate financial resources with relative index of 96 percent and
2. Delays in honouring payment certificates for work done with index of 93 percent were the most important causes of delay. By ranking, it meant all the respondents ranked these two factors as extremely important causes of delay.
3. Underestimation of the project duration with index of 83 percent and
4. Poor communication between contracting parties with index of 82 percent were third and fourth factors which were equally extremely important.
5. Complexity and difficulties for developers to access bank credit with index of 79 precent,
6. Change orders during construction with index of 78 percent,
7. Delays in sub-contractors work with index of 78 percent,
8. Bureaucracy in decision making with index of 77 percent,
9. Contractors improper planning during construction with index of 77 percent and
10. Delays in instructions from consultants with index of 77 percent are all very important and needed good practical/scientific recommendations to curb the risk..

5.1.2: Identification of solutions to causes of delay most relevant to Ghanaian contractors.

Respondents were asked to identified and rank the solutions to the causes of delays base on their importance. The factor analyses were used to group the factors under the following components as indicted below;

A. Proper Planning and Controlling

1. Human resources schedule, plant and equipment schedule; quality plan, and work schedule should be checked at tender stage.

2. At the tendering stage, strict adherence of the general tender information must comply.
3. Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes.
4. Design quality assurance reviews at the design stage.
5. Contractors must plan their work properly and provide the entire schedule to the clients.
6. At the design stage, adequate briefing, confirmation of client.
7. At the construction stage, adequate planning/resource management, work schedules, and monitoring.
8. Contractors must have knowledge about their resources strength and obtain up to date machinery.

B. Proper Financial Management

1. Clients should have the finances in time to pay the contractors after completion of a work.
2. Contractors must make sure they have a sound financial backing.
3. Clients have to make sure that the contractors are not selected based only on the lowest bid.
4. The owners should include mobilize all resources and get the necessary permissions before signing the contract.
5. Contractors should not take up the job, in which they do not have sufficient expertise.
6. Contractors should have able site-managers for the smooth execution of work.

C. Contracting Relationship

1. Good communication with the entire design team and integrating a design process and review on time.

2. Clients must make quick decisions to solve any problem that arises during the execution.
3. Consultants should monitor the work closely by making inspections and corrections at appropriate times.
4. The contract should include clauses of incentive for early completion.
5. Consultants should prepare and approve drawings on time.

D. Design Changes

1. Clients should not interfere frequently during the execution and keep making major changes in the design
2. Initial proper planning should be considered to reduce or avoid on necessary delays
3. Ascertain the educational qualification of suppliers regarding their materials performance knowledge.

To ensure projects delays are reduced to bearest minimum means identified recommended solutions must be adopted both practically and scientifically. In conclusion, this study points to the fact that, clients must have strong economical ability and financial arrangement for projects and make correct timely decisions. Secondly, to curb delays in projects execution needs all the contracting parties' commitment and devotion to address the challenges.

5.2: RECOMMENDATION

To decrease delays in construction projects the following recommendations are noteworthy.

5.2.1: Client

Initial proper planning is essential to the client, to ensure proper action plan, procurement plan and budget plan prepared before commencement of project. Proper payment schedules must be agreed by client and contractors thus, either monthly or stage completion payment before project commencement. Appropriate communication channel must be adopted by the

contracting parties to ensure smooth flow of information to avoid unnecessary delays or wrong instruction. Realistic duration and cost must be set for project. Clients should not select contractors based only on the lowest bid but should look for their working experience, key personnel, works executed similarly in nature, equipment holding, financial capacity, work load and experience in modern construction technology before choosing a contractor.

5.2.2: Contractor

On the part of the contractor initial proper planning will be of immense advantage. A master plan/work programme comprising; human resources schedule, plant and equipment schedule; material delivery and rotation schedule, quality control plan, and work schedule and their duration. Contractors should have able site-managers for the smooth execution of works and good site management. Contractors must plan their work properly and provide the entire schedule to clients for smooth flow of information and payment. Contractors must have knowledge about their resources strength and obtain up to date machinery and train their staff to meet the current trends.

5.2.3 Consultants

Consultants should plan properly to ensure that contract processes are duly followed, thus, documentation including preparation and approval of drawings to reduce variation during construction. Consultants should monitor their assigned work closely by making inspections and corrections at the appropriate time to reduce or avoid rework. Since consultant serves as an intermediary between client and contractors their communication skill is essential to aid smooth flow of information to other contracting parties.

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APPENDIX A:

Data Analysis Details

Table A1: Communalities Solutions to Delay		
	Initial	Extraction
Clients have to make sure that the contractors are not selected based only on the lowest bid	1	0.881
Clients should not interfere frequently during the execution and keep making major changes in the design	1	0.882
Clients should have the finances in time to pay the contractors after completion of a work	1	0.914
Clients must make quick decisions to solve any problem that arises during the execution	1	0.865
Consultants should monitor the work closely by making inspections and corrections at appropriate times	1	0.676
Contractors should not take up the job, in which they do not have sufficient expertise	1	0.800
Contractors should have able site-managers for the smooth execution of work	1	0.826
Contractors must make sure they have a sound financial backing	1	0.841
Initial proper planning should be considered to reduce or avoid on necessary delays	1	0.83
Change from the traditional contract type of the design-build type will safe time	1	0.899
Good communication with the entire design team and integrating a design process and review on time	1	0.763
consultants should prepare and approve drawings on time	1	0.738
Contractors must have knowledge about their resources strength and obtain up to date machinery	1	0.630
At the construction stage, adequate planning/resource management, work schedules, and monitoring	1	0.921
At the design stage, adequate briefing, confirmation of client	1	0.762
At the tendering stage, strict adherence of the general tender information must comply	1	0.738
The contract should include clauses of incentive for early completion	1	0.779
The owners should include mobilize all resources and get the necessary permissions before signing the contract	1	0.824
Contractors must plan their work properly and provide the entire schedule to the clients	1	0.8
Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes	1	0.784
Ascertain the educational qualification of suppliers regarding their materials performance knowledge	1	0.834
Human resources schedule, plant and equipment schedule; quality plan, and work schedule should be checked at tender stage	1	0.794
Design quality assurance reviews at the design stage	1	0.869
Extraction Method: Principal Component Analysis.		

Table A2: Total Variance Explained
Solution to the causes in construction industry

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.796	7.807	65.037	1.796	7.807	65.037
2	1.456	6.33	71.367	1.456	6.33	71.367
3	1.225	5.324	76.692	1.225	5.324	76.692
4	1.011	4.398	81.089	1.011	4.398	81.089
5	1.284	5.534	82.207			
6	1.285	5.588	82.275			
7	1.203	5.232	83.506			
8	0.854	3.712	84.218			
9	0.765	3.326	86.545			
10	0.617	2.684	89.229			
11	0.575	2.502	91.731			
12	0.421	1.831	93.562			
13	0.348	1.514	95.075			
14	0.238	1.037	96.112			
15	0.213	0.925	97.037			
16	0.189	0.822	97.859			
17	0.141	0.612	98.471			
18	0.129	0.562	99.034			
19	0.075	0.326	99.36			
20	0.061	0.266	99.626			
21	0.048	0.208	99.834			
22	0.023	0.099	99.933			
23	0.015	0.067	100			

Extraction Method: Principal Component Analysis.

Table A:3 Rotated Component Matrix[a]	Component			
	1	**2**	**3**	**4**
Clients have to make sure that the contractors are not selected based only on the lowest bid		**0.891**		
Clients should not interfere frequently during the execution and keep making major changes in the design				**0.921**
Clients should have the finances in time to pay the contractors after completion of a work		**0.869**		
Clients must make quick decisions to solve any problem that arises during the execution			**0.574**	
Consultants should monitor the work closely by making inspections and corrections at appropriate times			**0.679**	
Contractors should not take up the job, in which they do not have sufficient expertise		**0.813**		
Contractors should have able site-managers for the smooth execution of work		**0.595**		
Contractors must make sure they have a sound financial backing		**0.477**		
Initial proper planning should be considered to reduce or avoid on necessary delays				**0.788**
Change from the traditional contract type of the design-build type will safe time				**0.724**
Good communication with the entire design team and integrating a design process and review on time			**0.680**	
Consultants should prepare and approve drawings on time				**0.756**
Contractors must have knowledge about their resources strength and obtain up to date machinery	**0.563**			
At the construction stage, adequate planning/resource management, work schedules, and monitoring	**0.583**			
At the design stage, adequate briefing, confirmation of client	**0.793**			
At the tendering stage, strict adherence of the general tender information must comply	**0.538**			
The contract should include clauses of incentive for early completion				**0.789**
The owners should include mobilize all resources and get the necessary permissions before signing the contract		**0.855**		
Contractors must plan their work properly and provide the entire schedule to the clients	**0.645**			
Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes	**0.813**			
Ascertain the educational qualification of suppliers regarding their materials performance knowledge				**0.842**
Human resources schedule, plant and equipment schedule; quality plan, and work schedule should be checked at tender stage	**0.662**			
Design quality assurance reviews at the design stage	**0.838**			
Extracted Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization				

APPENDIX B

QUESTIONNAIRE FOR RESPONDENTS
TOPIC: KEY CAUSES OF DELAY IN CONSTRUCTION PROJECTS – A VIEW OF GHANAIAN CONTRACTORS

I wish to seek your views on the above mentioned subject. This questionnaire is designed to sample views from **Financial Class A3B3 & D3K3 categories of Road and Building contractors.** The information provided would be treated confidential and used specifically for academic purposes. The information would be vital for identifying the **most important** causes of delays in construction project in Ghana.

Section A. General Organization Information

1. Location of company ……
2. Type of works (Please underline) (Building / Civil Engineering)
3. Form of establishment

   Sole proprietorship (Enterprise)

   General partnership (Joint venture)

   Limited partnership (Joint venture)

   Joint Stock company (Company limited)
4. Working experience

   1-5 years

   6-10 years

   11-15 years

   More than 15 years

Section B: To identify the most important causes of delays.

Rank the following factors with respect to the heading for **section B**. Use a Likert scale of 1-5 where one (1) = Not Important; two (2) =Moderately important; three (3) =Important; four (4) = Very important; and five (5) = Extremely important.

	Causes of Delays.	1	2	3	4	5
1	Contractors improper planning during construction					
2	Delays in honoring payment certificates for work done					
3	Client's inadequate financial resources					
4	Contractors poor site management					
5	Underestimation of the project costs					
6	Complexity and difficulties in accessing bank credit (Client)					
7	Complexity, difficulties in accessing bank credit (Contractor)					
8	Poor supervision of works on site					
9	Underestimation of the project duration					
10	Errors in design and specifications					
11	Change orders during construction					
12	Unfavourable site conditions					
13	Bad weather condition,					
14	Poor communication between contracting parties					
15	Delays in sub-contractors work,					
16	Bureaucracy in decision making					
17	Lack of complete documentations before commencement					
18	Material price escalations					
19	Material procurement difficulties					
20	Building approval delays by statutory authorities					
21	Delay in instructions from consultants					
22	Foundation conditions encountered on site					
23	Mistakes in soil investigation					

Section C: To develop solutions to the most important causes

Rank the following solutions to the causes of delays on a Likert scale of 1-5 where one (1) = Not Important; two (2) =moderately important; three (3) =Important; four (4) = Very important; and five (5) = Extremely important.

	Solutions to the causes of delay.	1	2	3	4	5
1	Clients have to make sure that the contractors are not selected based only on the lowest bid.					
2	Clients should not interfere frequently during the execution and keep making major changes in the design.					
3	Clients should have the finances in time to pay the contractors after completion of a work					
4	Clients must make quick decisions to solve any problem that arises during the execution.					
5	Consultants should monitor the work closely by making inspections and correction at appropriate times.					
6	Contractors should not take up the job, in which they do not have sufficient expertise					
7	Contractors should have able site-managers for the smooth execution of work					
8	Contractors must make sure they have a sound financial backing					
9	Initial proper planning should be considered to reduce or avoid on necessary delays.					
10	Change from the traditional contract type to the design-build type will safe time					
11	Good communication with the entire design team and integrating a design process and review on time.					
12	Consultants should prepare and approve drawings on time					
13	Contractors must have knowledge about their resources strength and obtain up-to-date Machinery.					
14	At the construction stage, adequate planning/resource management, work schedules, and monitoring.					
15	At the design stage, adequate briefing, confirmation of client.					
16	At the tendering stage; strict adherence of the general tender information must comply.					
17	The contract should include clauses of incentive for early completion					
18	The owners should mobilize all resources and get the necessary permissions before signing the contract.					
19	Contractors must plan their work properly and provide the entire schedule to the clients					
20	Estimate activity duration according to the actual skills levels, unexpected events, efficiency of work time, and avoid mistakes					
21	Ascertain the educational qualification of suppliers regarding their materials performance knowledge					
22	Human resources schedule; plant and equipment schedule; quality plan, and work schedule should be check at tender stage.					
23	Design quality assurance reviews at the design stage					

Thank you.

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