



**FACULTY OF ENGINEERING AND BUILT ENVIRONMENT**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**EVALUATING DELAYS IN EXECUTION OF PUBLIC SECTOR CONSTRUCTION  
PROJECTS: A STUDY OF ROADS AND HIGHWAYS IN GHANA**

**ENGINEERING MANAGEMENT DISSERTATION**

**COURSE CODE MEC5095Z**

**IN PARTIAL FULFILLMENT OF THE M.ENG DEGREE**

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**FOR DR SHAW & DR WINDAPO**

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## **ABSTRACT**

This study investigates delays in execution of public sector construction projects in Ghana. A review of literature revealed that previous studies on construction projects focused on cost, time overruns, as well as the causes of delays. It is against this background that this study assesses the causes and effects of construction project delays and means of averting such delays.

The research design used in obtaining empirical data from a sample of 290 respondents was a survey research design. Questionnaires were used as instruments for data collection, and a Statistical Package for Social Sciences (SPSS) used for the data analysis. The statistical tools employed in the study include frequencies, percentages, Relative Importance Index (RII), Spearman correlation analysis and Chi-Square Test.

The findings of the study revealed that some critical contributors to road construction project delay in Ghana during the project execution phase are clients' low cash flow to complete the project, contractors' financial constraints on the project, and improper planning of the project life cycle especially during the bidding phase. Site restriction, weather effects and changes in governmental regulations were found to be the least contributors to projects delays. These delays have a negative impact on project performance, project duration and force project participants to modify and adjust their finances. Investigating the way forward, the study explored strategies that are for averting the delays in executing construction projects. The study found that respondents were undecided in their rating on adequacy of training for project staff on specific requirements of construction projects. Other factors such as adequate of knowledge of contractors on project task, effective mobilization and release of resources, early engagement of project managers as well as adequate and effective supervision of construction activities were each identified as strategies that are applicable and feasible in averting the delays in executing road construction project activities.

It can be concluded that several factors account for the delays in the implementation of construction projects and there are attendant effects on the timely and cost of delivery of these projects executed by the various departments. However, the potential strategies for mitigating the causes and effects of delays in executing construction projects in Ghana requires collective

efforts from all the stakeholders and actors in the construction sub-sector in the country to be effective.

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## **DEDICATION**

This academic achievement is dedicated to my parents, Eng. & Mrs. Narh.

## LIST OF ACRONYMS/ABBREVIATIONS

Act 663	Public Procurement Act of Ghana, 2003
ADR	Alternative Dispute Resolution
CEO	Chief Executive Officer
DAMUDS	Delay Analysis Method Using Delay Section
DS	Delay Section
DSs	Delay Sections
DUR	Department of Urban Roads
EOT	Extension of Time
FIFA	Federation International de Football Association
GDP	Gross Domestic Product
GoG	Government of Ghana
HND	Higher National Diploma
ICT	Information and Communication Technology
KSA	Kingdom of Saudi Arabia
LAD	Liquidated and Ascertained Damages
RII	Relative Importance Index
SCC	State Construction Corporation
SPSS	Statistical Package for Social Science
SPSS	Statistical Package for Social Science version 20
USD	United State Dollar

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# CHAPTER ONE

## INTRODUCTION

### **1.1 Background of the Study**

Large-scale public construction projects such as highway construction projects are mostly funded with donor support in most developing countries (Long, Ogunlana, Quang, and Lam, 2004)). Completing these projects on time is essential for developing countries like Ghana in view of the relevance of the roads construction subsector in the construction industry and its associated benefits. (Kaliba; Muya; and Mumba, 2009).

Bulky and volatile as the construction industry is, together with its capital-intensive nature makes the issue of delays on any project unfavorable to the survival of the industry. Such delays are caused by a gamut of factors, which consequently affect the timely completion of such construction activities (Bowen, Akintoye, Pearl, and Edwards, 2007). Ellis and Thomas (2003) indicated that the wide array of reasons attributable to such delays in construction worldwide ranges from the lack of proper scope definition, poor client briefing, funding, ineffective risk management systems, inexperienced project implementers, and institutional bureaucracies among others.

The issue of delays in construction projects all over the world has resulted in various problems for the sector and thereby attracting a bad image in that sector. (Toor and Ogunlana, 2008). Public construction project delays are acknowledged for its complexity, risk and cost due to its importance for the client, the professionals, and the contractor. Alaghbari (2007) acknowledged that project delays may range from a few days to over a year and that delays by one party can influence the scheduled project life span. Once there is a delay in any part of a project, it tends to affect other parts of the project particularly when such delays tend to have a significant effect on the overall project duration (Clark, 1989).

Sambasivan and Soon (2007) also indicated that besides cost and time overrun, delays cause numerous other effects on the project and the participating parties such as disputes amongst members, litigation and in some cases contractor abandonment of the

project. Such projects according to Clough (1986) are likely to affect the client to the extent that they may suffer hardship when the project is not delivered on time. It also results in rising expenditure or falling revenue once delay goes beyond its specified timelines (Clough, 1986). This results in the lack of production or outcome and higher material costs through inflationary expectations of price and increases in the cost of labor. Clough (1986) further explained that delays have financial implications for the contractor in the form of non-productive labor, material delivery schedules, overhead expenses, unused equipment and machinery (Clough, 1986).

According to data from Ghana Statistical Service (2007), the construction sector is seen as contributing significantly to the Gross Domestic Product (GDP) of Ghana, specifically 8.5% of total GDP. It is also an avenue for employment of the semi-skilled and the skilled labor force of Ghana. Fugar and Agyakwah-Baah (2010), in their study, stated that the construction sector serves as one of the major catalysts for the development of other industries such as manufacturing, ICT and more recently, the oil and gas industry (Fugar and Agyakwah-Baah, 2010).

The construction industry has an indispensable influence on the economy of Ghana. Despite this, the industry is confronted with conspicuous challenges. Among these challenges are the delays in the execution of construction project. This heightens the importance of further empirical investigations into the causes, effects of delays on road construction projects as well as strategies to avert these delays in the construction industry in Ghana. This effort is geared towards making findings to inform policy and to contribute to knowledge as far as construction sector is concerned.

## **1.2 Problem**

Delay in execution of construction projects in Ghana is a major developmental constraint acknowledged by all stakeholders in the country. It is commonly discussed with emphasis on the effects of such delays on project completion, cost and time overruns (Frimpong, Oluwoye, Crawford, 2003; Addo, 2015). However, the situation of delays in execution of road construction projects has rarely received adequate attention in terms of research efforts that potentially could unlock the solution to the

core problems associated with road construction projects in Ghana. This implies that adequate information is lacking on delays in road construction project and its associated ramifications on the overall development of Ghana. This leaves a gap for further investigations that would comprehensively contribute towards addressing the factors of delays in road construction projects in the country (Amoatey, Ameyaw, Adaku and Famiyeh, 2015); Addo, 2015; and Frimpong et al., 2003). In addition, Kwamena and Charity (2007) found that in Ghana the delays in project execution adversely affect the time, quality, and continuity of construction projects. It is evident from the studies that there is inadequate research work on delays in execution of construction projects. It is also clear that these previous studies on delays in construction projects were skewed towards addressing cost overrun, causes of delays and to determine factors of delays in construction projects as well as limited in geographic scope. Against the background of this literature review, this study assesses the causes, effects, and strategies for averting delays in executing road construction projects in Ghana using the road construction projects of Department of Urban Roads as a case study.

### **1.3 Aim and Objectives of the Study**

The aim of the study is to identify delay factors in public construction projects in Ghana. The specific objectives of the study are:

1. To identify the causes of delays in execution of construction projects of the Department of Urban Roads.
2. To analyze how the execution processes of construction projects are affected by the delays.
3. To identify strategies that can avert delays in construction projects of the Department of Urban Roads.

## **1.4 Research Questions**

The following research question was examined in this study:

1. What are the causes of delays in execution of construction projects of the Department of Urban Roads?
2. How are the execution processes of construction projects affected by the delays?
3. What strategies are feasible to avert delays in construction projects of the Department of Urban Roads?

## **1.5 Significance of the Study**

It is envisaged that the study would help policy makers such as the Ministry of Finance and Economic Planning, Ministry of Transport, Ghana Highway Authority and the Department of Urban Roads to formulate the appropriate strategies to address the delays in public road construction projects. Specifically, this is expected to help streamline the operations of the various agencies, consultants, architects, contractors to eliminate the perennial delays in road construction projects of the Department of Urban Road. Finally, it is believed that the study will help provide a guide for further studies on the delays in road construction projects in Ghana, both public and private.

## **1.6 Organization of the Report**

The dissertation report is presented in five chapters. Chapter one covers the introduction of the study. It focuses on the background of the study, the problem statement objectives of the study; research questions, the significance of the study; scope and limitations of the study. Chapter two reviews existing literature relating to theories of factors of delays in construction projects, some empirical findings as well as effects these delays have on contractors and Ghana as a whole. Chapter three explains the methodological framework of the study. It also addresses the research design, approach, and strategies.

It discusses the types and sources of data, ethical considerations, sampling techniques and the limitations of the study. Chapter four discusses data analysis and the findings of the survey. Chapter five includes the summary of findings of the study, conclusion, and recommendations based on the findings and suggestions for future research.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter discusses the various literature on the subject matter. The essence of this was to ensure that the research gaps were identified and subsequently filled by the current study. In a broader scope, the literature review addresses the delays factors, how those factors affect construction projects and the strategies that can be adopted in averting such adverse effects of delays in executing construction projects in Ghana.

#### **2.1 Overview of the Construction Industry**

The construction industry is an indispensable sector of every economy in the world because the outputs of the industry's activities facilitate socio-economic growth and advancement of every economy. Construction industries all over the world spur growth of economies primarily due to the contribution the sector makes to the economies of these countries by providing the relevant infrastructure that spurs the growth of other industries (Ofori, 2012). The construction industry provides the hardware of every economy in terms of provision of a road network, social services infrastructure, markets, and offices for delivery of government machinery, railways, and the factories for production and distribution of goods and services (Ofori, 2012). This means that the construction industry in every economy facilitates national productivity, distribution and delivery of services (Ofori, 2012). The livelihoods of the people depend on the effectiveness of the construction industry (Ofori, 2012). A flourishing construction industry in many countries over the world contributes significantly to the Gross Domestic Product (GDP) of those countries. The sector, therefore, has the singular capacity to contribute directly to the growth of economies of those countries because of its growing size in those economies (Ofori, 2012).

Similarly, Chileshe and Yirenkyi-Fianko (2012) noted that the construction industry is one of the main industries that contribute to job creation in most economies and as such is a key component of the gross domestic product (GDP) of many countries. However,

holistically analyzing the construction process, the net output of construction forms a very small portion of the construction process itself. The gross construction output emanates from the intermediates inputs of the construction process from other sectors of the economy such as the services industry and the material suppliers (Chileshe and Yirenkyi-Fianko, 2012). In the economy of Ghana, it is evident that the construction industry is noted for its relevance and contribution to the economy. The construction sector is responsible for 2.3% of jobs created nationwide and contributes averagely contributes 8.5% to the gross domestic product. In addition, the construction industry provides a means of production for other industries (Ghana Statistical Service, 2007; Fugar and Agyakwah-Baah, 2010).

Furthermore, in a developing country like Ghana, there are several actors involved in the construction industry. There is combined involvement of the government and private individuals who operate in the construction industry with the aim at providing construction services to the people of Ghana. Besides roads, the governments' activities in this sector include the development of schools, hospitals, airports, and infrastructure (Ofori, 2012). In terms of direct actors, there are governments' construction implementation and supervisory units like the Department of Urban Roads, Ghana Highways Authority, The Department of Feeder Roads, and many privately owned construction firms. The activities of these stakeholders entail the use of experts with diverse expertise such as; engineers, architects, surveyors, economist, and planners. These stakeholders interact in their operation and generate outputs for the benefits of society (Ofori, 2012).

The contribution of the construction sector to Ghana's economy was acknowledged by World Bank (2003) that the sector contributes to growth in the Gross Domestic Product (GDP) of Ghana whiles generating employment opportunities for sections of Ghanaians who operates in that sector. However, Aryeetey and Kanbur (2005) indicated that despite the relative importance and contributions of the construction industry in the economy of Ghana; the industry is still characterized with gross inefficiencies in the processes of contract management, low implementation of project management practices, cost and time overrun among other excesses.

In the view of Assibey-Mensah (2008), in the past, multi-national construction firms such as the companies of Lang and Woodorow among other foreign firms operated and controlled the activities in the construction industry in the country during the early 1990s. These companies were operating efficiently for some time until it started missing its targets on various state construction projects due to time and cost overruns. The failure of these companies was part of the basis for diversification and subsequently the establishment of the State Construction Corporation (SCC) with the sole objective of construction of highways, bridges, feeder roads, and urban roads efficiently and in the most cost-effective manner. However, the contemporary trend of how construction project is handled have significantly changed. Most of the public construction projects in Ghana are bided for by multinational and local construction firms. During the bidding process, the local government agencies such as the Ministry of Roads and Transport, Works and Housing, Ghana Highway Authority, Ministry of Water Resources, and Departments of Urban and Feeder Roads are responsible for monitoring (Chileshe and Yirenkyi-Fianko, 2012). The construction sector of Ghana has recently experienced dynamic fluctuations. This was due to revision of the pattern of activities and laws, the volatility of economic conditions, political uncertainties pertaining to changes in government and its impact on the continuation or otherwise of construction projects as well as competition within the construction industry in Ghana (Assibey-Mensah, 2008).

## **2.2 Construction Project Delays**

A construction delay can be explained as the untimely completion of construction project work in comparison to the contract completion schedule. According to Sambasivan and Soon (2007), construction delays can be greatly reduced when the causes of delays are identified and addressed (Sambasivan and Soon, 2007). Considerable attempts by project management professionals in the industry and researchers to address the problem of delays in construction project execution are yet to produce adequate positive results (Sambasivan and Soon, 2007). According to Aibinu and Odeyinka (2006), despite the advancement in technology, and an improved understanding of project techniques by management, construction projects are continually delayed and project completion dates are still being prolonged beyond the forecasted completion date. In the construction industry, the word “delay” refers

primarily to a later commencement or execution of activities in the activity schedule, material deliveries going against schedule or project not being delivered according to the agreed contract (Pickavance, 2005).

A study conducted by Dayi (2010) revealed that delay may occur during the pre-construction phase of the project lifecycle, that is, the commencement of the conception phase including project meetings, through the design phase to the signing of the contract between the client and the service provider being engineers and contractors alike. However, it was established that most project delays occur in the construction phase, representing a period of construction execution of ongoing building works (Dayi, 2010). It was further noted that several controllable and uncontrollable factors were responsible for construction delays and that they greatly affect the project schedule negatively. According to the researcher, it is known knowledge that delays have negative impacts on project performance and cause enormous difficulty for contractors leading to disputes and enmity amongst project participants and stakeholders (Dayi, 2010).

Akinsola (1996), in a similar study, identified that project delays results in either time extension, which prolongs the project duration, or projects activities are accelerated with overtime works, which also has a negative result of adding extra expenses to the project. Although a proportion of the project's unforeseen expenses are included in the bill as a contingency, the additional expenses, more often than not, exceed the inputted contingency. This is because the contingency is often subjective and dependent on the individual responsible for compiling the bill of quantities (Akinsola, 1996). The participating parties to the contract agree on the extra cost and times attributing to the delay. Despite this, in most cases, problems arise between the participating parties regarding the right to monetary or time claims (Akinsola, 1996). It is clear from the study that construction project delays are critical issues. It also raises issues of effective implementation and responsible contract administration on the managers and stakeholders involved in the construction project. This means that either the contractor or the client who assumed the responsibility of implementing and releasing resources respectively have been ineffective in their roles regarding the implementation of the project.

Construction project delays cause frustration and lack of collaboration amongst the participating parties. This, in turn, places unnecessary pressure on the project manager who is liable for the workability and collaborations of the project team for a successful project (Long et al. 2004). Their study recognized that many researchers have investigated the factors causing cost and time overruns as well as delays, and their consequent effects on quality, safety, and output are the common challenges in most types of projects. The success or failure of a construction project, regardless of its nature anchors predominantly on the practicability of the construction schedule (Ochoa, 2013). It was further revealed that delays in the construction schedule negatively influence all participating parties (Ochoa, 2013). Despite this, the owners or clients of the projects are often forced to absorb the cost of any such extra expenses to ensure that projects continue and are not further delayed (Ochoa, 2013).

It is obvious that several studies have acknowledged the issue of construction project delays as a problem that negatively influences on the implementation of such projects. The studies showed how delays expose projects to cost and time overruns, breeds frustration and litigation, and compromises the quality and performance of the projects (Ochoa, 2013; Akinsola, 1996; Dayi, 2010; Sambasivan and Soon, 2007; Aibinu and Odeyinka, 2006). According to Keane and Caletka (2008), the construction industry involves many complex processes, which ought to be finely integrated to ensure prompt project delivery. They further noted that a robust construction project consists of successful coordination of all construction and engineering professionals, artisans, suppliers, trade unions, financiers, local authorities, manufacturers, trade contractors and other construction projects which all impact on a nation's economy (Keane and Caletka, 2008).

### **2.2.1 Excusable or non-excusable delays**

Available studies have shown that construction delays are either excusable or non-excusable. The authors noticed that differentiating between excusable or non-excusable delay is based on the parties involved and on the contract clauses and provisions made pertaining to project delays (Ochoa, 2013; Trauner, Marginally, Lowe, Nagata, and Furniss, 2009; Ahmed et al., 2003). In view of the above, the authors concur that,

normally in a standard construction contract document, types of delays that warrant time or cost compensations are specified. Trauner et al., (2009) indicated that excusable delays are delays resulting from an unplanned and unforeseeable event beyond the contractors or the subcontractors' control. Delays resulting from events such as fire outbreaks, floods, acts of God, client variation, mistakes and errors in specifications, variation in site conditions or buried services, abnormally weather condition, material delivery delays, acute illness, death or absence of one of the contractors without notice are known as excusable delays (Williams, 2003 and Levy, 2006).

### **2.2.2 Compensable and Non-compensable Delays**

Excusable delays are either compensable or non-compensable (Ahmed et al., 2003 and Mubarak 2005). Mubarak, (2005) revealed that compensable delays are either caused by the client, the client's representative or the project manager. In such situation, according to the author, the contractor will be entitled to claims of time, cost, or both. Trauner et al. (2009) opine that changes in the work scope, site conditions and site accessibility are among the factors that should be considered under compensable delays. The author further explained that non-compensable delays are delays that are excusable but do not attract compensation claims by the contractor (Trauner et al., 2009).

According to Mubarak (2005), excusable non-compensable delays are typically not within the control of either the client or contractor and may be caused by factors such as bad weather conditions, force majeure, conflicts, national crises, floods, fires, or labor strikes. She concluded that should such delays occur the contractor should be entitled to time extension but not additional compensation. A contract condition determines whether a delay warrants the extension of time, monetary compensation or both (Trauner et al. 2009).

### **2.2.3 Concurrent Delays**

Mubarak, (2005) defines concurrent delay as a simultaneous occurrence of at least two independent causes of delay. These delays often include excusable and non-excusable

delays. Although Trauner et al. (2009) also defined concurrent delays as two different independent delays that occur simultaneously; Levy (2006) considered it as an overlapping delay. Levy (2006) indicated that the contractor, the client, or any of the project participants might cause concurrent delays. As such, Levi (2006) is of the view that neither the client nor the contractor is entitled to compensation for damages, (Levi, 2006).

#### **2.2.4 Critical and Noncritical Delays**

Trauner et al. (2009) focused on assessing how delays affect the progress and completion of construction projects. The study addressed critical delays to include an extension of project completion period while those delays that have no effect on the project completion schedule are classified as noncritical delays.

In construction, every project has what is known as a critical path of activities such that, should any of the activities on the critical path be delayed, the project is consequently delayed. It was further revealed that besides the cumulative duration of the critical path activities and the sequence of activities, physical constraints and pace of work on the site also contribute to the project duration (Alkass et al. (1996).

### **2.3 Causes of Delays in Construction Projects**

The causes of delays in construction projects have been described as the factors that are responsible for extension and obstruction of timely and successful completion of such projects. This current study in Ghana addresses the causal factors by reviewing such factors that are commonly revealed by previous researchers as major causes of delays on construction projects.

The essence is to glean available information on the causes of delays in construction projects and to ascertain the foundation for assessing the causes in the context of Ghana (Frimpong et al., 2003; Ravisankan and Anandakumar, 2014; and Amehl et al., 2010). Presented in Table 2.1 are the core factors available in the literature as the causes of delays in construction projects.

Table 2.3: Factors responsible for Delays in Construction Projects

S/No	Causes Factors of Delays	Categories	Sources
1.	Low cash flow to complete the project	Financial related Factors	Frimpong et al. (2003), Addo (2015) Ravisankar & AnandaKumar (2014) Mezher et al., (1998), Sunjka and Jacob (2013), Faridi and El-Sayegh (2006), Fugar and Agyakwah (2010), Arditi et al. (1985); Remon Fayek Aziz (2013); Charles et al (2015).
2.	Financial constraints of contractors		
3.	Delay in running bill payments to the contractor		
4.	Ambiguity in specifications and conflicting interpretation by parties	Non Clarity of Project Scope	Mutaleb and Kishk (2010); Assaf and Al-Hejji (2006); Owolabi et al. (2014); Kikwasi (2012); Baloyi and Bekker (2011); Toor and Ogunlana (2008).
5.	Change Orders/Slow decisions from Client		
6.	Rework due to change of design or variation	Poor Stakeholder Relationship	Remon Fayek Aziz(2013);
7.	Rework due to error in execution		
8.	Lack of motivation for contractors to early finish		
9.	Delays in the supply of raw materials		

10	Delay in material delivery by vendors	Improper Planning	Remon Fayek Aziz (2013); Sambasivan and Soon (2007); Fugar et al (2010).
11	Delay in material procurement by contractor		
12	Unrealistic time schedule of contracts	External Factor / Unforeseen Circumstances	Asaaf and Al-Hajji (2006); Frimpong et al (2003); Ogunlana et al. (1996); Odeyinka and Yusuf (1997); Haseeb et al (2011) and Wei (2010).
13	Improper planning of contractor at bidding		
14	Lack of project planning		
15	Poor means of contracting	Lack of Qualified and Skilled Technical Personnel	Al-Kharashi and Skitmore (2009), Azlan et al. (2011),
16	Extreme weather conditions		
17	Changes in government regulations and laws	Lack of effective communication	Owolabi et al., (2014), Kikwasi (2012), Saleh Al-Hadi et al (2009)
18	Lack of skilled technical personnel		
19	Inadequate experience of contractor	Obtaining permission from local authorities	
20	Lack of communication among project actors		
21	Obtaining permission from local authorities		

22	Restricted access at site			
23	Poor contract management	Poor	Construction	Project
24	Poor site management	Management and Supervision		
25	Poor labor productivity			
26	Nonavailability of design on time			
		Sunjka and Jacob (2013), Kumaraswamy (1997), Toor and Ogunlana (2008), Azlan et al., (2011),		

Through the review of available literature on the subject matter, the causes of delays as per Table 2.1 were identified. Several factors as per Table 2.1 have been acknowledged as the major causes of delays in the execution processes of construction projects. However, these factors according to literature can be broadly grouped into five main categories of factors. These five main categories of factors are; improper techniques and tools, incompetent designers/contractors, social and technological issues, site related issues; and poor estimation and change management. For purposes of this current study, the review on the causes of delays in construction projects was carried out and presented on the themes of the factors that are commonly identified by the previous studies as causes of delays in construction projects. These broader factors of construction project delays are; financial related factors, non-clarity of project scope, Poor stakeholder relationships, improper planning, external factors, /unforeseen circumstances, lack of qualified and skilled technical personnel, lack of effective communication as well as poor construction project management and supervision.

### **2.3.1 Non-clarity of Project Scope**

Non-clarity of project scope is a category of factors contributing to the delays in construction projects. This category of factors includes; ambiguity in specifications misinterpretation and differing interpretations by contracting parties, change orders and slow decisions from clients, rework due to change of design leading to variations as well as rework due to errors in execution. These factors are identified by several studies as a major cause of delays in construction projects. A study conducted by Motaleb and Kishk (2010) investigated the causes and effects of construction projects delays in the United Arab Emirates (UAE). It was revealed by the study that several factors contribute to delays in construction projects in UAE Motaleb and Kishk (2010). It was revealed that the most significant causes of delays in the UAE are client-related factors and change orders from the client's team Motaleb and Kishk (2010).

According to this finding, clients at several stages of the construction project life sometimes make an arbitrary request of changes that affect the original design of the project and that mostly disrupts the pace of work and subsequently delay the timely and cost-effective delivery of construction projects Motaleb and Kishk (2010). Another study conducted by Assaf and Al-Hejji (2006) on the causes of delays in construct

projects revealed seventy-three (73) causes of delays in construction projects. However, the most critical causes of delay identified by the contractors, consultants, and owners were change orders (Assaf and Al-Hejji, 2006). According to them, change orders by clients is a major factor that frustrates the timely completion of construction projects especially those projects that belong to private investors (Assaf and Al-Hejji, 2006). It is shown by this study that when construction project owners decide to vary their request in terms of changing their taste regarding the design of the project initially planned and contracted, it affects the entire implementation of the project. It is evident that the time, cost, and frustration may result from the change orders for contract owners. This concern is similar to what was found by Motaleb and Kishk (2010) at the United Arab Emirates.

In a similar study, Faridi and El-Savegh (2006) did an assessment of causes and effects of delays in construction projects in the United Arab Emirates. The study revealed that 50% of the construction projects in the United Arab Emirates result in delays and are not completed on scheduled time. This was attributed to owner interference in the form of changes in taste and design to original project design. It was lamented that most projects up to 50% are obstructed by owner interference that affects completion of construction projects on scheduled project durations.

A study by Owolabi, Oloke, Olusanya, Tunji- Olayeni, OwolabiDele and Omuh (2014), who investigated the causes of construction delays in Nigeria, also revealed that changes in design really affects the timely execution of construction projects. The fact that construction projects are obstructed when the owners change their mindset on the design interest and request for changes along construction project execution is a major obstruction that cannot be overlooked when addressing the causes of delays in construction project implementation and execution (Owulabi et al., 2014). Similar to studies by Motaleb and Kishk (2010) and Asaaf and Al-Hejji (2006); Owolabi et al. (2014) have equally demonstrated that construction project owners could be the source of delays in construction projects through wrong changes in their orders. In a situation like this, the contractor might have done most procurements, recruitments and other arrangements in the process of execution. This process is brought to a halt due to a change in the mindset of the client particularly on what to be delivered as outputs. This

poses serious difficulties and may result in cost and time overruns aside the likely misunderstanding and litigations amongst actors involved in the construction chain.

In addition, Kikwasi (2012) conducted a study in Tanzania and assessed factors that cause delays in construction project delivery. As part of the findings of the study, it was revealed that variation in design during construction, due to changes in preference of the owners, is a critical factor that draws construction projects backward (Kikwasi, 2012). It was observed by the study that changes in design on the project execution processes have retarded the pace of project activities and has adverse disruption in resource requirements thereby delaying the timely execution of construction projects in Tanzania (Kikwasi (2012). It is interesting that following from the various studies a number of them have acknowledged change orders as a critical factor that causes delays in construction projects. It stands to reason that changes in preferences of project owners is indispensable and should be considered in the current study of road construction projects in Ghana. It means that several factors might be informing the changes in orders especially in the case of road construction, some social and political factors could play out and that could generate sudden changes in orders by the government. Baloyi and Bekker (2011) also conducted a study of factors that cause delays in execution of 2010 FIFA World Cup stadia construction. According to this study, changes in construction design was revealed by the study as a critical factor that contributed to delays in 2010 FIFA construction projects (Baloyi and Bekker, 2011). It was revealed that disruption due to changes in design along the process of construction projects of 2010 FIFA contributed significantly to delays in timely execution and delivery of projects (Baloyi and Bekker, 2011). One can imagine how changes in design could emerge as an obstruction during the construction of FIFA projects in the year 2010. That means that project implementation process was obstructed because contractors along their activities suffered requests of obligators because of changes in either the design and/or as and when a particular aspect of the construction is executed. These all served as the delays factors that cannot be overlooked.

A study conducted by Arditi, Akan and Gurdamar (1985) on the dominant causes of construction delays in Turkey revealed predominant causes of delay to include frequent changes in orders. This implies that owners have the habit of frequent changes to their designs and that poses some form of challenges once the project commences. This

situation usually causes delays to the pace of progression of the construction projects in Turkey (Arditi, Akan, and Gurdamar, 1985).

In view of the above studies, it is established that changes in orders and design are indispensable cause factors that pose challenges to smooth, timely and cost effective execution of construction projects in several countries across the world. Though studies are not comprehensively covering every aspect of the economy, the available literature on some of the sectors of the various economies have however proven change orders and design as a critical delay factor in construction projects. The current study of construction projects in road construction sub-sector in Ghana will take into consideration the change orders and design as a variable in the study.

### **2.3.2 Financial related Factors**

Finance is generally acknowledged by the reviewed literature sources as a major factor that contributes to delays in construction projects. The financial issues are addressed variously by scholars in similar studies but include; financial constraints of contractors and low cash flow to complete the projects. Frimpong et al., (2003), who undertook a study on the causes of delays and costs overruns in the construction of groundwater projects in Ghana, revealed that difficulties in payments from agencies are critical factors that delay timely completion of such projects. It was, however, indicated that the incidence of difficulties in payments from agencies could be mitigated when actors involved ensure that such construction projects are planned, controlled, and monitored in terms of financing schedule of activities during the implementation cycle of the project (Frimpong et al., 2003). In addition, Addo (2015) investigated the effect of construction project delays on project delivery in Ghana. In the study, Addo (2015) identified fifty-seven delay factors and grouped them into eight categories. The author also identified six delay effects and thirty-five aversion strategies. The results of the study showed that delays in monthly payment of construction expenses is another factor that causes delays in delivery of construction projects in Ghana. The implication of this finding is that most construction project contractors in Ghana have the habit of engaging laborers, mostly casual, to operate over the lifespan of the project who are often paid on monthly basis. In situations where such workers suffer delays in their payments,

there is the high tendency that productivity will automatically be affected. This definitely will contribute to the delays in timely execution of the project activities. Quality in these circumstances is usually affected as a whole.

In addition, a study on the causes and effects of construction projects in Nigeria revealed that lack of funds to finance construction projects from the start to finishing was a major cause of delay in timely delivery of construction projects (Ravisankar and AnandaKumar, 2014). According to them, initial mobilization characterizes most projects and subsequent finances are mostly prolonged thereby wasting project scheduled time of execution. It is a common experience that most construction projects in many parts of Africa countries suffer this type of challenge, where contractors appear to have abandoned construction projects for some time because the initial mobilization is exhausted and subsequent transfers are not forthcoming. This is an evidence of poor commitment and attitude of actors involved in the contract. It is evident that the situation would have affected time and cost effectiveness of construction projects in Nigeria. Whether it is a case of non-availability of funds for projects or it is the politics involved in the construction sector will be assessed in the current study as a financial factor aimed at unveiling the situation in the road construction sub-sector in Ghana.

In a similar study in Jordan, Odeh and Battaineh (2002) revealed that challenges of finance and payments during construction projects is a very common challenge in the industry that contributes to delays on the project and results in cost and time overruns. A survey was conducted in Lebanon to address the causes of delay in the industry. Taking into consideration the perspectives of contractors, owners, and professionals it was revealed that a financial difficulty was a major cause of delays in the execution of construction projects. The study elaborated that delays in the release of project funding frustrate contractors who lack owner resource capacity to pre-finance the project activities. Thus, by waiting for the release of funds, the project's schedule of timely delivery is sometimes prolonged (Mezher et al., 1998).

In Saudi Arabia, Alaghbari (2005) conducted a survey that revealed the causes of delay on the industry by analyzing the survey data collected from twenty-three (23) Contractors, nineteen (19) Consultants, and fifteen (15) owners. It was indicated that

among other causes payment delays and slow cash flows were critical factors that cause delays in execution of construction projects. These, according to the study, affect the entire project implementation and may cause the need for additional expenditure in the review of delays that would expose the budget of the project to changes in prices of goods and services thereby compromising the time value of the project funds (Alaghbari, 2005). It is not surprising that the consequence of this situation may trigger issue of frustration and may lead to litigations once actors fail to compromise for the uptake and continuity of the project activities.

A study carried out in Nigeria by Sunjka and Jacob (2013) identified the causes of delays in construction projects in Nigeria Region of Niger Delta. In this assessment, ten (10) most common factors that cause delays in construction projects were revealed by the study including the lack of timely release and payment of contractors as a critical factor that cause delays in executing construction projects in the study region of Nigeria. According to this study delays in payments is a very challenging difficulty for contractors especially where the contractors lack mobilization capacity and the network such that they could finance the entire construction projects in advance of payments (Sunjka and Jacob, 2013). As earlier indicated, most contractors win their contracts out of other considerations other than merit. Some contractors lack the capacity both logistics and technical expertise to execute construction projects. In such cases, the project's entire implementation is affected because most payments become problematic and that could trigger series of industrial unrest and struggle during the project life. Owolabi et al., (2014) in a similar study of assessing the causes of delays in construction projects found that lack of funds to finance construction projects to completion is one of the critical causes of delays in construction projects. Owolabi et al., (2014) elaborated that funds are mostly given to contractors as initial mobilization to start up construction projects pending subsequent release of funds for the completion of entire projects. According to the study, this identified factor poses a challenge to most contractors because the constraints of payments obligations delays effective pace of project implementation. It is worth noting that delays associated with contractors' inability to proceed with work when initial mobilization is exhausted are problematic in developing countries. Is it that adequate funds were not secured prior to project award or is it a matter bureaucracy that frustrates the prompt and timely release of funds or

better still is the attitude of the contractor? These questions need to be catered for in the current study.

A study in Tanzania has revealed that there are some major causes that delay and disrupt implementation of construction projects. According to the study, such factors are a great source of risks that potentially compromise the smooth timely delivery of the construction requirements. It was further revealed by the study that delays in payments to contractors, lack of funds for project completion and delays in compensation payments among the parties and actors involved in the construction execution are major factors that cause delays in implementing and executing construction projects in Tanzania (Kikwasi, 2012).

A study carried out in the United Arab Emirates involved the assessment of causes of delays to construction projects taking stalk of views of consultants and contractors. The findings of the study showed that payments and financing of construction projects is a critical factor that affects the timely execution of construction projects. According to the study, difficulty in financing construction projects from initiation to completion is usually disturbed by breakages in the timely release of funding to continue project activities. In addition, Faridi and El-Sayegh (2006) found in a research conducted in the United Arab Emirates that difficulties associated with payment and financing of construction project activities throughout the project lifecycle is a factor that causes delays and hinders timely completion of construction projects in the area. Similar studies in Jordan by Sweis et al (2008) addressed the major causes of delays in the construction industry in Jordan. The study unearths that financial difficulties faced by the contractors is the leading cause of construction delay. This implies that difficulties associated with construction project execution are indispensable when addressing causes of delays in construction projects.

In another study, Saleh Al-Hadi et al (2009) have found in their study of causes and effects of delays in construction projects in Libya that lack of funds to pay for complete project expenses and the cash flow difficulties during project implementation are among the prominent causes of delays in executing construction projects in the country of Libya. These financial difficulties have always characterized construction projects and because most contractors upon exhausting the initial mobilization may have to

delay awaiting the release of remaining funds for completion of the project. This forms the basis upon how construction projects are delayed in Libya.

Fugar and Agyakwah (2010), in their study of the causes of delays in construction projects, revealed that the most prominent cause of delays is the factor relating to financial categories of issues. It was accordingly indicated that delays in the release of project funds were a categorical factor that is commonly observed during the execution of construction projects in Ghana. In a related study, Arditi et al. (1985) conducted a research to identify the dominant causes of construction delays in Turkey. The study revealed that the public agencies and contractors' financial difficulties were predominant causes of delay in implementing construction projects in Turkey. The dynamics of prices in the market is a very critical aspect of the market that generally affects most operating budgets. In the construction projects, the long procedures involved in planning and executing construction projects allow the swift market dynamics to have an impact on the prices of materials that are required by the project. According to James et al. (2014), the consequences of delays manifest into increased project and labor cost, loss of productivity, reduced contractor profit margins, conflicts, and a general decline development pace. In their study of the causes and effects of delays on project duration, it was revealed that fluctuation in material prices is one of the main contributors to untimely project delivery in Nigeria. This finding was further corroborated by that of Ravisankar & AnandaKumar (2014) who studied the Quantification of Delay Factors in Construction Industry and established that fluctuations in prices of goods and services affect the construction budget and hence, the likelihood of shortages are abounded with this situation. Al-Hadi et al (2009) undertook a study in Libya that assessed the causes and effects of delays in construction projects. Their study revealed that cash flow difficulties in terms of frequent changes in the prices of construction materials were a critical cause of delays to the effective implementation of construction projects in the country. Another study by Daniel (2014) who carried out a study of delay causes in Ghana revealed that some of the key contributors to project delays include client inadequate financial resources and delays in honoring payment certificates for work done.

A recent study by Charles et al (2015) did an assessment of the causes and effects of delays in public sector housing projects in Ghana. The study was limited to causes and

effects of project delays in Ghana using data collected from only one state institution. The results from the study showed that the critical factors that contribute to project delays in Ghana are; delay in payment to contractor/supplier, inflation/price fluctuation, price increases in materials as well as inadequate funds from sponsors/clients. The findings of this study are also emphasizing the contribution of financially related factors to delays in construction projects in Ghana. However, the scope of the study was very narrow and could not have given a broader picture of what actually pertains to the construction industry in Ghana.

### **2.3.3 Poor Construction Project Management and Supervision**

In respect to the management of construction projects, a study by Sunjka and Jacob (2013) in Niger Delta region of Nigeria have found that poor contract management is a core factor that causes delays in construction projects in the Delta region of Nigeria. According to this study, poor management of construction projects exposes the projects to shoddy works, ineffectiveness, and poor quality. It also revealed that resources are usually not put to optimum use when there is poor management of the implementation of construction projects. The direct consequence of this is the delays in completing the projects since experts monitoring and supervision will require standardization and rework of poor quality tasks during the project life. A study conducted by Chan and Kumaraswamy (1997) also found that poor site management, poor project management, and poor supervision is a factor that causes delays in construction projects in Hong Kong. Another study by Kikwasi (2012) in Tanzania has identified poor site management as a major cause of project delays in the country. In the quest to identify the factors that cause delays to executing construction projects in Tanzania, it was found that among other factors, most projects in the country are delayed because of poor site management. This, according to the study, exposes the entire project activities to numerous fluctuations and obstructions thereby leading to slowdown in the progression of the project execution in Tanzania. In a study conducted by Saleh Al-Hadi et al (2009), it was revealed that inappropriate planning is another factor that causes delays in implementation of construction projects in Libya. In Thailand, Toor and Ogunlana (2008) conducted a survey using one of the major construction projects in Thailand as a case study. Similar to other studies, the focus of the study was to assess the main

contributors to delays in construction projects in the country. Data from project participants such as architects, consultants, and contractors was gathered and analyzed. The study revealed that poor contractor management and poor project management were amongst the top delay causing factors. An evaluation study in Malaysia also addressed the cause of delays in construction projects. It was revealed by the study that poor site management was one of the contributors to delays in execution of construction projects in Malaysia. It was indicated that because of poor management of activities at the site, work progression is mostly ineffective due to the human factor and hence, delays in the progress of work schedule (Azlan et al., 2011). Upon a study on causes and effects of construction delays, it was revealed that project delays are due to a number of factors. The study revealed that poor site management and supervision was among the critical factors that cause delays in execution of construction projects.

#### **2.3.4 Lack of effective communication**

Lack of effective communication in construction project execution and its related factors are acknowledged by available literature as contributing factors to delays in construction projects. Issues such as; lack of communication among project actors, obtaining permission from local authorities involved in the projects and restricted access at project site have variously contributed to a lack of effective communication and that have contributed to delays in construction projects. These factors are variously acknowledged by previous studies as among the major cause of delays in construction projects. A study by Owolabi et al., (2014) in their search of the causes of construction delays identified lack of adequate information and communication among the actors involved in construction projects as a major factor that contributes to delays in effective and timely delivery of construction projects. Delays in information flow is another factor that is revealed by previous studies in Tanzania as a major cause of delays in timely execution of construction projects (Owolabi et al., 2014). Kikwasi (2012) did an assessment of factors that cause delays, disruptions, and risks to smooth and timely delivery of construction projects in the country. It was established by the study that delays in information flow affect the effective communication between and among project participants such as contractors, engineers, supervisors among others (Kikwasi, 2012). Meanwhile, effective communication during project implementation is very vital for quality and timely delivery of the construction projects (Kikwasi, 2012). Saleh

Al-Hadi et al (2009), who studied the causes and effects of delays in construction projects in Libya, found the causes of delays in construction projects in Libya to include the absence of active communication. In the analysis, the study indicated that communication is indispensable in project execution and that absence of communication is a serious gap that could be overlooked because it retards and cause a retrogression in the activities of the project thereby delaying the timely completion of the project (Saleh Al-Hadi et al., 2009).

### **2.3.5 Lack of Qualified and Skilled Technical Personnel**

Lack of qualified and skilled human resource to deliver professional services during construction is another factor that causes delays in construction execution in many countries in the world. Previous studies have investigated and found this factor as a very potent cause of delays in construction projects. In the Saudi Arabia, a study carried out by Al-Kharashi and Skitmore (2009) was aimed at determining the importance of the causes of delay in the industry. This was done in seven groups, that is, clients, consultants, contractor, labor, materials, and contract and interrelationship factors. It was revealed by the study that the factors that influence delays in the industry the most include undersupply of workforce, lack of qualified professionals and unskilled labor (Al-Kharashi and Skitmore, 2009). The study further indicated that the inadequate availability of various categories of technical personnel compromises and slows down the pace of construction works in the country (Al-Kharashi and Skitmore, 2009). In Malaysia, there was an evaluation study conducted by Azlan et al. (2011) around Klang Valle as part of efforts to evaluate the causes of delays in construction projects in that country. Seven major factors were revealed by the study as the core causes of delays in the construction project execution in the Klang Valle (Azlan et al., 2011). In particular, the study addressed commercial construction projects and found, among others, that shortage of skilled labor force was a major factor that significantly contributes to delays in executing construction projects in the Malaysian city of Klang Valle (Azlan et al., 2011). According to the study, shortage in skilled labor force tempt contractors to use unskilled personnel as replacement for whose services are not very germane to the very task expected and also, the pace of work and quality of output could have been

compromised and thereby delaying the timely completion of the construction project (Azlan et al., 2011).

### **2.3.6 Improper Planning**

Improper planning among other related factors is another category of factors that contribute to delays in construction projects. These factors include; delays in material procurement by contractors, unrealistic time schedule of contracts, improper planning of contractors at the bidding, lack of project planning and poor means of contracting. A study conducted by Aziz (2013) investigated and ranked delay factors in construction projects in Egypt after the Egyptian Revolution. This study found improper planning, lack of project planning and poor means of contracting as well as delays in material procurements as delay factors in construction projects during the post-revolution period in Egypt (Aziz (2013). Another study by Sambasivan and Soon (2007) was an investigation of the causes and effects of delays in Malaysian construction industry. The study revealed ten (10) main causes of delays out of varied potential causes and effects. Among the most important factor revealed by the study was contractors' improper planning (Sambasivan and Soon, 2006). According to Frimpong et al., (2003), who studied cost overruns and delays on groundwater projects in Ghana, revealed among others that inadequate pre-planning is one of the critical factors that cause delays in groundwater projects and thereby resulting to cost overrun in such ground ware projects. In another study by Fugar et al., (2010) the causes of delays of building construction projects in Ghana were investigated. This study found improper planning as a critical factor that contributes to delays in delivery of building construction projects in Ghana. As per this study, building construction projects are sometimes delayed in their execution and delivery due to improper planning in view of unrealistic time schedules and lack of project planning. The above studies have shown that improper planning is very critical delay factor that cause delays in construction projects. This factor is observed in many forms such as improper pre-planning, lack of planning, poor means of contracting and delays in procurement. These delay factors constitute improper planning and its effects in construction projects. It is based on the relevance of proper planning that underscores its assessment in this current study of road construction projects in Ghana.

### **2.3.7 Poor Stakeholder Relations**

Poor stakeholder relations also form another category of factors that contribute to delays in construction projects. Lack of motivation for contractors to an early finish, delays in the supply of raw of materials, as well as delays in material delivery by vendors, are some of the related factors that result from poor stakeholder relations and thereby contribute to delays in construction projects. Delay in material delivery was also revealed by the study conducted by Aziz (2013) in Egypt. The findings of that study included delays in delivery of construction materials as a contributory factor that cause delays in executing constructions projects after the Egyptian revolution. . It can be observed that delays in delivery of material are a very critical factor that is likely not taken care of by contractors in particular. Usually, contractors may order and make procurement arrangements without taking into consideration other factors that might obstruct timely delivery of the materials and once delays are experienced, you can expect that construction activities will be affected greatly. On the part of vendors, the same could occur where vendors give an assurance on delivery times but are obstructed by unforeseen events and situations. These are indispensable since some of them are bound to occur except when actors involved in construction projects do efficient scanning of the environment and associated dynamics to an extent that any occurrences will be mitigated with backup plans. It is no doubt that delays in delivery and supply of materials are a major potential delay factor that is worth investigating in this current study.

### **2.3.8 External Factor / Unforeseen Circumstances**

This category of delay factors describes the various factors that contribute to delays in construction project timely, cost effective and quality execution. These factors include extreme weather conditions and changes in government regulations and laws. Several studies including Frimpong et al (2003) and Ogunlana et al. (1996) acknowledged the extreme weather conditions as having contributed to delays in construction projects in several parts of the world. Odeyinka and Yusif (1997) in a study on the construction industry addressed the causes of delays in building projects in Nigeria. The study

classified the actors of construction delays into project related and those that are external (Odeyinka and Yusif, 1997). They grouped the causes of delay as project participants and extraneous factors (Odeyinka and Yusif, 1997). According to the findings of the study, the causes of delays were revealed to include; acts of nature, bad weather, labor disputes, and strikes (Odeyinka and Yusif, 1997). In addition, Asaaf and Al-Hajji (2006) in their study revealed that the major external factors responsible for delays in construction projects in Saudi construction industry are weather conditions, regulatory changes, and unforeseen site conditions. Also, Haseeb et al (2011) in their study in Pakistan's construction industry, using a ranking method, identified the most important factors of construction project delays to include; unexpected site conditions, changes in rules and regulations, natural disasters, organizational changes, conflicts and problems with neighbors (Asaaf and Al-Hajji, 2006).

These findings corroborated the earlier findings of Wei (2010) who reported eight external factors that cause delays in construction projects. According to Alghbari et al. (2007), Bad weather conditions; transportation delays; poor site conditions; poor economic conditions; changes in laws and regulations; and external work due to public agencies such as roads, utilities, and public services are among the main factors that cause delays in construction projects.

It was obvious that several factors constituting external and/or unforeseen circumstances account for some delays in construction projects. These factors include; poor economic conditions, changes in laws and regulations, poor weather and site conditions, natural disasters, unexpected site conditions, organizational changes, conflict situations as well as labor disputes and strikes. These factors constitute unforeseen and external factors that are mostly outside the control of project stakeholders. They pose delay challenges to the construction projects in many parts of the world. It is therefore not out of place to consider this as a major factor - of delay in the current study of road construction projects in Ghana since each of these factors are potential sources of delays.

### **2.3.9 Summary on causes of delays**

In view of the review presented on the causes of delays in construction projects, it was clear that, no universal factor is responsible for delays in construction project execution. These cause factors differ across various environments. Several factors have been identified by various scholars who have researched into the causes of delays in construction projects. Among these factors, are those identified and presented in Table 2.1. However, the literature review on these factors covered few of them that were found to be prominently addressed by the previous studies on the causes of delays across the different geographical set ups. Meanwhile, the current study took into consideration the cause factors contained in Table 2.1 as indicators for measuring the causes of delays in construction projects, taking into consideration the construction projects of Department of Urban Roads in Ghana.

### **2.4 Effects of Delays on Construction Projects**

This section addresses the second objective; assessing how the delays in executing construction projects affect the project delivery. Literature was considered in line with how construction projects are affected by execution delays. Several studies have been carried out addressing how the causes of delays have effects on construction projects. It is undoubtedly clear from available studies across different countries that delays in construction projects have some form of effects on the outcome of such projects. Among the commonly identified effects of delays on construction, projects are presented in Table 2.1 below.

Table 2.4: Commonly Identified Effects of Delays on Construction Projects

Effects of Delays	Sources
<ul style="list-style-type: none"> <li>● Cost and time overrun (Rework financing and time elongation).</li> <li>● Low quality and standardization of projects.</li> <li>● Loss of money for extra spending</li> <li>● Litigation and Law suits</li> <li>● Project rejection and general sense of apprehension</li> <li>● Lack of continuity and complete abandonment of projects.</li> <li>● Disputes</li> </ul>	<p>Majid (2006);  Haseeb et al. (2011);  Ahmed et al. (2000);  Sunjka and Jacob (2013);  Amoatey et al. (2014);  Salunkhe and Patil (2014);  Kikwasi (2012).</p>

In view of the commonly identified effects of delays in construction projects, literature was further reviewed on the some of these factors aimed at indicating the gaps by showing aspects of the study area that are adequately addressed and those requiring further investigations in the current study.

### **2.4.1 Cost and Time Overrun**

Cost and time overrun are identified as major effects that results from delays in executing construction projects; usually described as a situation that exposes construction projects to rework financing and time elongation. A study conducted by Ameh (2011) investigated the relationship between productivity in construction sites and time overrun on projects in Nigeria. It was revealed by the study that significant relationship exists between time overrun and labor productivity in construction sites in Nigeria. This relationship is inversely proportional such that labor productivity decreases as time overruns increase. The study sums that a reduction in productivity causes an equal amount of increase in time overrun. Similarly, an increase in productivity on site causes an equal amount of decrease in time overrun. Another study by Majid (2006) has acknowledged that several effects result from the delays of construction projects. The study identified cost overrun as a major effect of delays on construction projects. Other studies conducted in Indonesia during the 1990s by Kaming *et al.* (1997) found that cost overruns were mainly caused by mistakes in the bill of quantities resulting from inaccuracies in take-off, an increase in material costs and unforeseeable cost increases. In a similar study of evaluating the cost overruns and delays on groundwater projects in Ghana, Frimpong *et al.* (2003) identified that the main contributor to delay in the industry according to contractors is the lateness of monthly payments by the clients. On the other hand, clients ranked contractors poor performance as the major contributing factor to delays on the projects. Reviewing public sector construction projects in Nigeria, Dlakwa & Culpin (1990) concluded that “fluctuations in material, labor and plant costs”, “construction delays” and “inadequate pre-planning” are the three main reasons for cost overruns.

### **2.4.2 Low Quality and Standardization of Projects**

Previous studies conducted on the effects of delays have made findings in confirmation that delays in construction projects have adverse effects on construction projects across several countries. A study conducted by Majid (2006) on the causes and effects of construction revealed that several factors account for the delays in execution of construction projects. It was further indicated that these factors adversely affect most

construction projects. The study revealed that the effects of delays in construction projects are cost overrun and low-quality projects leading to shoddy outputs (Majid, 2006).

### **2.4.3 Loss of Money for Extra Spending**

According to Al-Hadi et al (2009), delays in construction projects execution are a major cause for concern for most construction companies in Libya. The results of the study showed that delays in construction projects have adverse effects such as increased costs, loss of productivity and revenue, lawsuits between owners and contractors and contract termination. It further mentioned disputes and lawsuits that result from the misunderstandings from the project theme. A study conducted in Pakistan by Haseeb et al. (2011) addressed some of the causes and effects of delays in the construction industry. The study revealed that delays in executing construction projects breed disputes, negotiations, lawsuits, total desertion, litigation, and project abandonment. It was also revealed that delays in construction project execution lead to demand for additional capital and extra time for the construction work. In addition, the study found that the loss of wealth, time, and capacity are among the prominent effects of delays in executing construction projects in Pakistan. In addition, the study further revealed that some negative effects of delays include loss of time, overhead expenses, and additional expenditures on material, equipment, and labor. In another study, Ahmed et al. (2000) summed that the effects of delay in construction projects could lead to; confrontational relationships, disbelief, lawsuit, financial issues, project rejection, and causes unnecessary anxiety amongst project participants. Using systems approach, Nwachukwu (2009) analyzed the effects of materials constraints to the success of construction project in Nigeria. The study established that efficient material management on site is very important as this has a significant effect on the project duration and success. Especially delays in the procurement of materials could have negative effects in construction projects and could result in untimely delivery of projects. The study concludes that due to the importance of material management, it is imperative that the project management team and the contractor are mindful of material usage on site.

In a similar study in Nigeria, Aibinu and Jagboro (2002) undertook an assessment of the main effects of delays on construction projects delivery. The study revealed that working above scheduled; thus, time overrun, project above budgeted cost thus, cost overrun, disagreement, arbitration, total abandonment of the project by the contractor and lawsuit amongst participating parties were the main effects of delays on construction projects in Nigeria. The study further established that delay of construction project often results in time extension. These extensions of time usually lead to extra financial expenditures. Disputes amongst project participants are also identified as another effect of delay, mostly between contractor and client for either extension of time or financial claims for under budget or variation. In another study, it was found that time overrun, work exceeding plan budget, negative social impact, wasting resources with respect to labor and equipment and disagreement resulting in dispute were the major effects of delays on construction projects (Kikwasi, 2012). A study conducted on multistory construction projects in Indonesia revealed that the effects of cost overruns are not only severe but are also project threatening and more common than time overrun (Kamming et al., 1997). Alzan et al. (2011) in a study of the causes and effects of delays on construction projects have identified six (6) effects of delay as per the analysis of the variables. They included cost overrun and extension of time, rescheduling, company reputation loss, loss production, and efficiency as the most common effects of delay in construction projects. According to Li et al. (2000), when a delay occurs, the project manager is faced with three options. These effects are extra money to complete the construction work, compromising quality by reducing standards as well as specification and rework due to modification of the work. The resultant effects are further manifested in the form of overtime work and/or increase project resources both labor and equipment in order to meet the project time. Increasing the project resources could lead to an increase in project costs, thus cost overrun. It was explained that introducing overtime could result in declined productivity and poor performance could lead to rework. Sunjka and Jacob (2013) further revealed in their study that three most critical effects of delays on construction projects in Niger Delta are Cost overruns, time overrun, Disputes, and claims. In a related study in Malaysia, it was found by the study that cost and time overrun are dominant effects of delays in Malaysian construction projects (Sambasivan and Soon, 2007). According to Conlin and Retik (1997), delays often result in misunderstanding and disputes between the client and the contractor. In addition, Aibinu and Jagboro (2002) conducted a study on

the effects of construction delays on project delivery in the Nigerian construction industry. They acknowledged that delays in executing construction projects in Nigeria have become endemic that affect construction projects negatively. It was revealed by the study that time and cost overruns were common effects of delays. This study further found Delay had a significant effect on completion cost and time of sixty-one (61) construction projects that were under study. It was further revealed by the study that, to alleviate the adverse effects of construction delays, contingency allowances need to be well calculated, project management procedures need to be well established and site activities should be at no less than the optimum levels with the correct number of labor on site. Another study by Salunkhe and Patil (2014) addressed the effects of construction delays on project time overrun in India. This study was underscored by the recognition of delays in the construction industry. The study highlighted the types of construction delays, which results in cost and time overrun.

The study also revealed the adverse effects of construction delays on project duration, project cost, and project success. Amoatey *et al.* (2014) also conducted a study in Ghana, analyzing causes and effects of construction delay in Ghanaian state housing construction projects. The study reveals the causes of delays and the adverse effects of delays on construction projects in Ghana. The findings of the study showed that the delays in project execution affect the delivery of construction projects in terms of cost overrun, time overrun, litigation, lack of continuity by client and arbitration. Another study that was identified as very relevant to the current study is that of Sambasivan and Soon (2007). They assessed the causes and effects of delays in Malaysian construction industry. This study recognized the delays in the construction industry as a worldwide crisis from which the Malaysian construction industry cannot be exempted. The study revealed six main effects of delays in executing construction projects to include; disputes, cost and time overrun, litigation, and project abandonment by the contractor. This study also established a practical relationship between the causes and effects of construction delays. The study was a good attempt to assess the causes and effects of delays in executing construction projects. Similar studies in Ghana will reveal the causes and consequences of delays on construction projects, in order to generate strategies for averting the delays in executing construction projects. The current study is a contribution towards augmenting evidence on the causes and effects of delays on construction projects in Ghana. It is clear that the effects of delays on construction

projects have been acknowledged by previous studies that revealed several effects including mistrust; cash-flow problems; time overrun; cost overrun; arbitration; litigation and total abandonment as among the major aspects of effects that possibly results from delays in executing construction projects.

## **2.5 Strategies for Averting Delays in Construction Projects**

This section of the study addresses the objective of the study on identifying the strategies that are tentative for averting delays in construction projects in Ghana. Some previous studies that addressed strategies of mitigating delays in construction work were consulted as part of the literature review. A study conducted by Anthen (2009) have revealed that delays and construction projects can be mitigated based on the application of some practices during project lifecycle. This study unveiled that when closure phase is implemented as planned the issue of delays could be avoided. According to this study, practical steps such as

*“Completion: Ensure that the project is 100% completed to avoid disputes and delay in payments; Documentation: Detail documentation will ensure that future changes are made with little extraordinary effort, Project system closure: this includes closing the financial system i.e. all payments, work termination; Project review: this can help in transfer of tangible knowledge of time and cost, know-how and know-why; Disband project team members and complement achievement as soon as possible to avoid cost overrun due to extra overhead; as well as Stakeholder satisfaction: provide all the necessary information required by stakeholders to avoid conflicts and doubt”*( Anthen, 2009).

The study argued that when the above steps are observed, it allows for a timeline of the project lifecycle to be observed. This makes it possible for the project team to assess their progress on the project, the activity schedule and the financial schedule of the project (Athens, 2009). A study by Ade et al. (2013) on the control of cost overruns in construction projects in the Malaysian industry explained how cost overrun could be avoided in the construction industry. The study upon reviewing several effects of construction delays offered three strategies that are tentative for mitigation of the effects

of delays on construction projects. These strategies are the proactive, re-active, and organizational strategy. These findings were further corroborated by Olawale and Sun (2010) who equally found that the proactive, re-active and organizational strategy are measures that are germane and appropriate for adoption and implementation at the planning stages of the project. Another study by Indhu and Ajai (2008) was a study of delay management in construction projects. It was a case study that was geared towards identifying the strategies by which delays and associated effects on construction projects could be managed. It was revealed by the study that effects of delays can be avoided by improving managerial responsibility in project implementation and also that, the basic role of management such as planning, forecasting, organizing, supervision; sanctioning and monitoring regulating among others needs to be strengthened to reduce delays and attendant effects on the overall construction projects.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.0 Introduction**

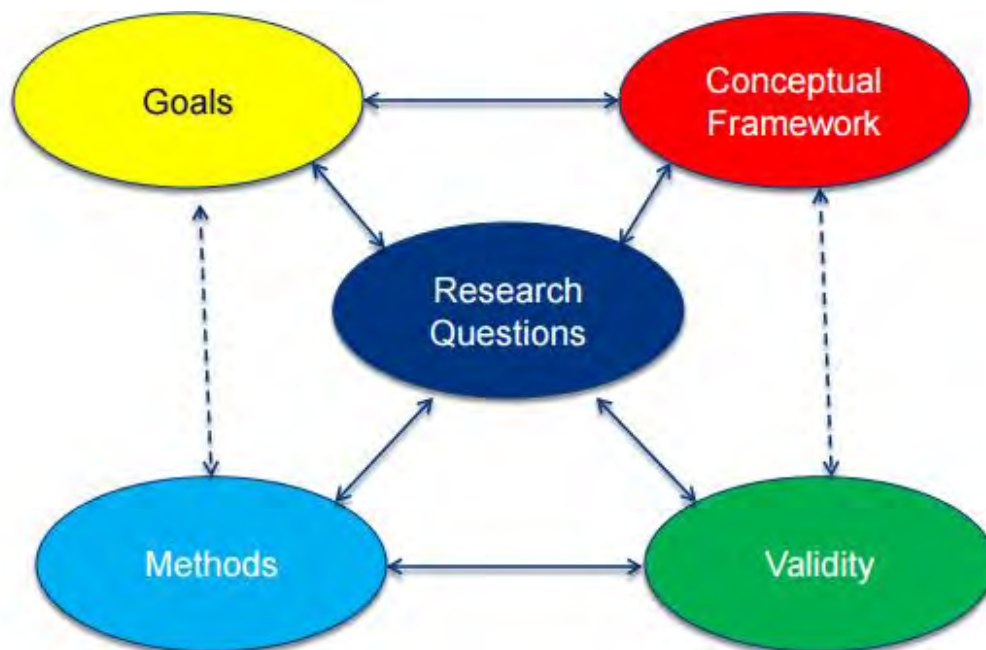
Brown (2006) notes that research design tells one how to conduct a research study and provides enough guidance for readers of the design explanation to conduct a study themselves should they wish to do so. In this chapter, the research design is described including the methodology and methods. The methods of selecting a sample, collecting data and analysis of the data are explained. This is followed by a discussion of the ethical considerations for this study and the chapter is concluded with a description of the limitations of the study.

#### **3.1 Research design**

Research design explains the framework and context within which a study is conducted. It is a blueprint of a study and describes how the research fits into a realm of research (Saunders et al., 2007). A research design ensures that the research questions serve the purpose of the study and addresses the objectives (De Vaus, 2001). In the context of qualitative research, Maxwell (2005) defines the research design model as being flexible and interactive while Bryman (2012) opines that although not flexible, quantitative research involving an array of participants can be interactive. Like De Vaus (2001), Maxwell establishes interactions amongst the five core research design elements and links them as illustrated in figure 3.01.

In the context of quantitative research, the study is designed to employ the use of numeric as well as statistical method of analysis based on samples of a population to arrive at conclusions. Hence, a deductive strategy is adopted (Bryman, 2012).

**Figure 3. 01: Elements of research design**



(Adopted from Maxwell, 2005)

Maxwell (2005) explains that there is a close relationship between the research questions and the research goals and objectives noting that the conceptual framework informs these research questions. He further explains the double-sided arrows noting that, the goals of the research shapes the method used. However, it is constrained by the feasible methods that can be used in the study. The same relationship holds for validity and conceptual framework of the study. The relevance of the research conceptual framework depends also on the goals and questions posed in the research.

According to Yin (2003), research design is a strategic plan that outlines the thought process that creates a connection between the information to be collected from research participants and the conclusion deduced from the research questions (Yin, 2003).

### **3.2 Research Approach**

The research approach stems from the research philosophy. The approaches available to research can be categorized into deductive and inductive approaches. According to Hussey and Hussey (1997), the deductive approach uses empirical observations in testing a conceptual framework. For instance, an application of a deductive approach involves starting with theory or a conceptual framework, which guides the collection of empirical data. . In the context of this study, a deductive approach was adopted. The study was based on a survey conducted using a structured questionnaire (that was developed using theory) to gather data, which was analyzed by a statistical method using SPSS computer software.

### **3.3 Population**

The research population in the context of this study is generally the largest collection of individuals. The institutions that were identified as relevant to providing useful information to support the purpose of this study were grouped to from the population.

The population size was obtained from the Department of Roads and Highways. This was based on the available information on registered professionals in the industry in good standing with the Department. Accra and Kumasi were chosen because these two cities are the biggest recognized cities in the country with significant construction activities. The study was also targeted at the population categories such; Civil Workers, Road Contractors and Government establishments such as Ministry of Finance and Economic Planning, Regional Coordinating Councils, Ministry of Roads and Highways, Department of Feeder Roads, Department of Urban Roads, and Ghana Highways Authority.

**Table 3. 3: Population size for each of the selected Establishment**

<b>Establishments</b>	<b>Number of Professionals on Register</b>
Civil Works Consultants	1050
Road Contractors (Class A1B1 to A4B4)	1098
Regional Coordinating Councils and Economic planning	300
Ministry of Roads and Highways and Ministry of Finance	80
Ghana Highway Authority, Department of Urban Roads and Department of Feeder Roads	900
<b>Total</b>	<b>3420</b>

### **3.4 Sample and sampling technique**

This section of the study discusses the sampling procedure of the study. It presents the process of sample size determination and types of sampling techniques that were employed in the. Discussed below is the determination of the sample size for study.

According to Knight and Ruddock (2008), a set of data drawn from a population is what is termed as a sample. Mugenda (2008) explain that the different random sampling techniques that are available to researchers each affect the extent of generalization in the finding (Mugenda, 2008). The sample size was initially intended to be randomly selected from membership records. However, owing to the difficulties in locating certain addresses stated on the records and the continuous reshuffling of staff from one district to the other, the questionnaires were distributed based on the number of known staff available in each district unit visited.

To minimize the extent of generalization, a combination of techniques informed the mode of sampling in this study. To ensure equitable representation of the various professionals involved in the public sector construction projects, the technique of simple stratified random sampling was used. Due to the nature of the industry and the added difficulty in locating addresses in Ghana, participants' availability necessitated

the use of convenient and purposive sampling to ensure that the participants had enough experience (10 years) and could understand the questionnaire without the need for translation into the local dialect. Snowballing technique, as described by Mugenda (2008), was also employed to achieve the required sample size for the research. A method of stratified targeted random sampling and chain referral was widely used in this research. Knight and Ruddock (2008) opine that this method ensures that, although random, an equitable representation of the different professionals and stakeholders in the industry are represented (Knight and Ruddock, 2008).

### **3.5 Sample size Determination**

Per Mugenda and Mugenda (2003), the process of sampling is a strategic means of selecting participant such that the number of participants selected is representative of the population from which they are selected. The method used in determining the sample size is described in this section.

Sampling is a process that involves the selection of a proportion of a population as a representation of the whole study population. The scope of this study involved large public construction of roads in Ghana. Given this scope, two hundred and ninety (290) constituted the sample size of the study. These two hundred and ninety (290) sample size was determined using a statistical formula for determining sample size by Kish (1965). According to Kish (1965), sample size can be determined using the formula below. The statistical method was used in establishing the minimum sample size for Civil Works Consultants and Road Contractors for the study. The sample size was determined using the Kish (1965) statistical formula as stated below:

$$N = \frac{n^1}{(1+n^1/N)}$$

Where:

n = Sample Size

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

N = Population Size

S = Maximum standard deviation

V = Standard error of sampling distribution (0.05)

P = Proportion of the population elements that belong to the defined class.

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

#### Sample size for Civil Works Consultants

$$N = 35$$

$$n = 100 / (1 + (100/35)) = 25.93.$$

The Quantity Surveyor, the Engineer, and Deputy Engineer were sent the questionnaires since they are involved in road construction. This gives a total of seventy-eight (78) questionnaires to these Civil Works Consultants. (i.e. 3 (Number of personnel's) x 26= **78**)

#### Sample size for Road Contractors (Class A1B1 to A4B4)

The Ministry of Roads and Highways list 1,098-registered A1B1 to A4B4 road contractors in good standing as at December 2009. According to Oppong as cited in Osei (1993), "about 10% of registered contractors are actively engaged in construction work at any time". Against this background, it could be stipulated that out of the 1,098 registered A1B1 to A4B4 road contractors, only about 110 are actively involved in road construction.

$$N = 110$$

$$n = 100 / (1 + (100/110)) = 52.38$$

Questionnaires were sent to the Project Manager/Engineer and the Quantity Surveyor in the road contractors unit. This gives a total of hundred and four (104) questionnaires sent to these Road Contractors. (i.e. 2 (Number of personnel) x 52=**104**).

#### Sample size for Regional Coordinating Council (RCC)

$$N = 10$$

$$n = 100 / (1 + (100/10)) = 9.09$$

The Director, Deputy Director, and the Economic Planning Officer were sent the questionnaires. This gives twenty-seven (27) questionnaires to the Regional Coordinating Councils (i.e. 3 (Number of personnel) x 9=27).

Sample size for Ministry of Road, Highways, and Ministry of Finance.

The following personnel in these ministries above were given the questionnaires: The Director/Deputy Director, Head of Monitoring and Evaluation, Sector Head of donor funding. This gives six (6) questionnaires sent to the above Ministries i.e. 3 (Number of persons) x 2 (Ministries) = 6.

Sample size for Highway Authority, Department of Urban Roads, and Department of Feeder Roads.

$$N = 30 \text{ i.e. } 10 \text{ regions} \times 3$$

$$n = 100 / (1 + 3.33) = 23.$$

The following personnel in these government establishments above were given the questionnaires: The CEO/Director, Deputy CEO/Deputy Director, and Director of Quantities/Contract Manager/Regional Quantity Surveyor. This gives a total of sixty-nine (69). Questionnaires sent to the above government establishments.

The results of the calculations of the various sample size per actors in the construction industry are presented in Table 1 below. The essence is to find the aggregate of these sample sizes that constituted the total sample size of 290.

**Table 3.5: Sample size for each of the selected Establishment**

Establishments	Number of Questionnaires Allotted
Civil Works Consultants	78
Road Contractors (Class A1B1 to A4B4)	104
Regional Coordinating Councils and Economic planning	27
Ministry of Roads and Highways and Ministry of Finance	6
Ghana Highway Authority, Department of Urban Roads and Department of Feeder Roads	69
<b>Total</b>	<b>284</b>

### **3.6 Methods of Data Collection**

As per the research design adopted, data was gathered using a questionnaire survey. This method of data collection entails the use of survey questionnaires to generate responses from sampled respondents in each of the categories identified. This method involves soliciting information as answers to questions that are contained in the data collection instrument (questionnaire). Most of the targeted respondents who could read and write were given the questionnaires to respond at their convenience and return the completed questionnaires for processing. A Likert scale is a one-dimensional psychometric scale used in measuring the extent to which a participant agrees or disagrees with a question (Knight and Ruddock, 2008). As part of the data collection, the respondents were asked to rank the factors of project delay in public road projects using a five- point Likert scale (5 =Very High, 4 = High, 3 = Neutral, 2 = Low, 1 = Very Low). In addition, another five Likert scale used to measure the effects of delays on construction projects where; 5=Strongly Disagree, 4=Disagree, 3=Undecided, 2=Agree and 1=Strongly Agree.

#### **3.6.1 Data Collection Instruments**

According to Clarkson and Hodgkinson, (2007), in the construction industry, the traditional method of data collection is via the use of questionnaires (Clarkson and Hodgkinson, 2007). The main instrument of data collection used in this study was a questionnaire with a psychometric measurement of the Likert scale. The questionnaire was a structured questionnaire and it contained open-ended and close-ended questions. It was administered to respondents and the output analyzed to address the objectives of the study.

#### **3.6.2 Pilot Testing of the Instrument**

A pilot study was conducted using the questionnaires, which were administered at the Nsawam Assembly in Accra. In accordance with Mugenda and Mugenda (2003), who stated that pilot testing should be done in the same manner as intended to be conducted

in the actual study, the pilot testing involved a sample of questionnaires being distributed to the five groups of the study. This is also in accordance with Mugenda and Mugenda (2003) who suggest that a sample size of no more than 10% and no less than 1% should be used in Piloting. Piloting participants were encouraged to give feedback on the clarity, difficulty, relevance and appropriateness of the questionnaire (Mugenda and Mugenda, 2003). This feedback was used to reconstruct the questionnaires for use in the actual data collection.

### **3.6.3 Consistency and Dependability of the instrument**

According to Maxwell (2005), reliability in qualitative research, considering the difference in the perception of participants, cannot be standardized (Maxwell, 2005). The researcher can, however, establish reliability by proper documentation of research philosophy and paradigm, documentation of research procedures such that it can be replicated (an audit trail) or by using the technique of triangulation (Merriam 1998, p 204-207). The validity of the research instrument refers to the extent to which the research instrument addresses the purpose and objectives of the research (Kothari, 2004). The questionnaire used in the piloting attained approval from experienced research supervisors prior to administration for piloting to ensure that information gathered using the instrument can be used for the purpose of the research. Furthermore, feedback from piloting was used to design the instrument while maintaining the core elements of the questionnaire as approved by the experienced research supervisors. Using these two angles as point of judgment, the instrument can be deemed valid for the research (Sekaran, 2006)

### **3.7 Data Collection Procedure**

The data collection process entailed a number of activities. Firstly, the questionnaires were administered personally to those who opted for it. However, some of the respondents took up the questionnaires and responded to them at their convenience. The survey was carried out among corporate members of government establishments, and

randomly selected Civil Works Consultants and Road Contractors who have experience in the implementation phase of construction projects in Ghana's public sector.

The research began with literature review to identify the known causes of delay in the industry. From the literature review, 26 causes of delays were identified, the five major effects of delays, and the five strategies to avert the effects of these delays. These findings from the literature were used in developing the questionnaire based on the literature review. The questionnaire was divided into three parts. The first section deals with the causes of delay, the second deals with the effects of delay, and the last part addresses the strategies in averting these effects

### **3.8 Methods of Data Analysis**

Questionnaires were gathered and reviewed after which the questions were coded for malleability using computer software. The Statistical Package for Social Sciences (SPSS) was used as software to analyze the questionnaire data. The data was inputted, edited, analyzed, and interpreted to address the objectives of the study. Following the gathering of completed questionnaires, the data was extracted, coded, and inputted into the system. Data analysis was then done and presented appropriately in tables, charts or by way of narration in interpreting the results.

### **3.9 Model specification**

Relative Importance Index was used to determine the ranking of the different causes of delay.. Relative Importance Index (RII) was computed as:

$$RII = \frac{\sum_{i=1}^5 W_i X_i}{\sum_{i=1}^5 X_i}$$

Where:

$I$  = response category index = 1, 2, 3, 4, and 5 representing Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA) respectively.

$W_i$  = the weighted assigned to the  $i$ th response = 0, 1, 2, 3, 4, respectively.

$X_i$  = frequency of the  $i$ th response given as a percentage of the total responses for each cause.

The Spearman's correlation coefficient is calculated for the ranking using the following equation:

$$r_s = 1 - \frac{6 \sum d^2}{N(N^2 - 1)}$$

Where:

$r_s$  = Spearman's rank correlation coefficient.

$d$  = the difference in ranking

$N$  = the number of variables (26).

### **3.10 Ethical considerations**

Especially in qualitative research and quantitative research that is subjective in nature and involves a diverse range of participants, it is imperative to address the ethical implication of the research (Merriam, 1996). In this regard, the researcher has to duly protect and inform all participants on the content and extent of the research. This is to ensure that no harm is caused to participants and confidentiality as well as dignity is respected. The importance of ethics in research is iterated by Maxwell (2005), who opines that ethics should be considered in a holistic manner to assess every part of the research rather than just certain parts (Maxwell, 2005). The table below depicts how the ethical aspects of this research were addressed.

Table 3.10: Ethics consideration

Ethics Considerations	Yes/No	Application
Informed consent of participant	Yes	The researcher explained the purpose of the questionnaire and the research to all participants. Participants were given the opportunity to ask questions for clarity. Following which participants had the option to opt out of the research process. All participants participated voluntarily and were handed an informed consent note for reference.
Confidentiality	Yes	The researcher fully understood the concerns of participants due to on-going undercover works being conducted by some investigative journalists in the country. The researcher assured the participants of the confidentiality and anonymity of information provided by participants.
Does the action as far as possible maximize social benefits and minimize social injuries?	Yes	By Utilitarian standards, although the sample size is relatively smaller compared to the actual population, care was taken and procedures and formulas were used in ensuring that the sample taken was a true reflection of the population. Using a sample rather than the whole population maximized social benefits and minimized social injuries. The reverse would be true if the entire population was used, as it would have been practically impossible and a costlier process.
Is the action consistent with the moral rights of those whom it will affect?	Yes	Care was taken in ensuring that the process infringed on no participants moral right. Participation was voluntary. Further care was taken in ensuring that participants were not victimized. Although it cannot be guaranteed that the questionnaires were not answered in groups, the researcher ensured that individuals answered the questionnaires independently or away from the construction/ office environment. As far as possible, questionnaires were administered individually and collected personally by the researcher.
Will the action lead to a just distribution of benefits and burdens?	Yes	In conducting this research, the researcher ensured that participants from the various sectors were proportionately represented by using methods well known in the industry for research.
Does the action exhibit appropriate care for the wellbeing of those who are closely related to or dependent on oneself?	Yes	Care was taken to ensure the wellbeing of all participants. The research was, however, no threat to external parties. The research ensured that as far as possible participants could not see each other's answers and thus could not threaten each other's well-being.
		The research method used in this research was widely used and debated by experienced authors in the industry. Literature was reviewed to ascertain the most dominant research methods in the industry before applying to this research.

Choice of research method		
Biasness in Sampling		Participants were not selected based on preference but rather on availability. Although stratified sample was stratified, participants were selected randomly based on availability, willingness, and knowledge on the subject
Triangulation		This is inherent in the research process as a wide range of literature was consulted. In addition to the use of mixed methods and sampling methods, participants from sectors other than construction formed part of the research sample.

(Adopted from Cavanaugh, Moberg, and Velasquez (1995).

### **3.11 Limitations of the Study**

This research had limiting factors both due to the subjectivity nature of the research and others due to the design of the research. Limitations to this research were as much as possible, within the power of the researcher, minimized through expert advice and thorough literature review.

From the onset of the project, the researcher introduced a limitation by choosing to conduct a case study on the subject matter using an organization outside the researcher's country of location. The researcher reduced this limitation upon relocation to the country of the organization in which the case study was to be conducted. After the pilot study, questionnaires were redesigned with the feedback from the participants to better reflect the Ghanaian context and to protect the participants.

Although experts guided the researcher through the literature selection, some of the literature materials selected by the researcher were from secondary rather than primary sources. With the understanding of the limitations in secondary data, the researcher made efforts to reduce the number of secondary sources used. The researcher's background emanated from the construction industry. Although the efforts were made to reduce the researcher's biasness, it must be admitted that the possibility of researcher biasness cannot be completely eliminated considering the subjective nature of the study.

The key limitation to this research was the timing of the research. A private investigative journalist, popularly known as "Anas", conducted the research in the public sector at the time when the entire public sector was "secretly" under investigation. Due to this reason, participants were not willing to provide answers to open-ended questions nor have their interviews recorded for fear that "Anas" may be watching. Interviews had to be eliminated from the research. The questionnaires had to be redesigned to ensure that participants were protected and would not be incriminated.

### **3.12 Summary**

The chapter addresses the research design methods that were employed during the study. The chapter also addresses the research paradigms and philosophical underpinning to this research study. The chapter presents the research design, the study population, sampling techniques, methods of data collection and analysis, as well as the analytical models that were used for effective analysis of the objective variables of the study. The next chapter presents the discussion and analysis of study results.

## CHAPTER FOUR

### DATA ANALYSIS AND DISCUSSIONS

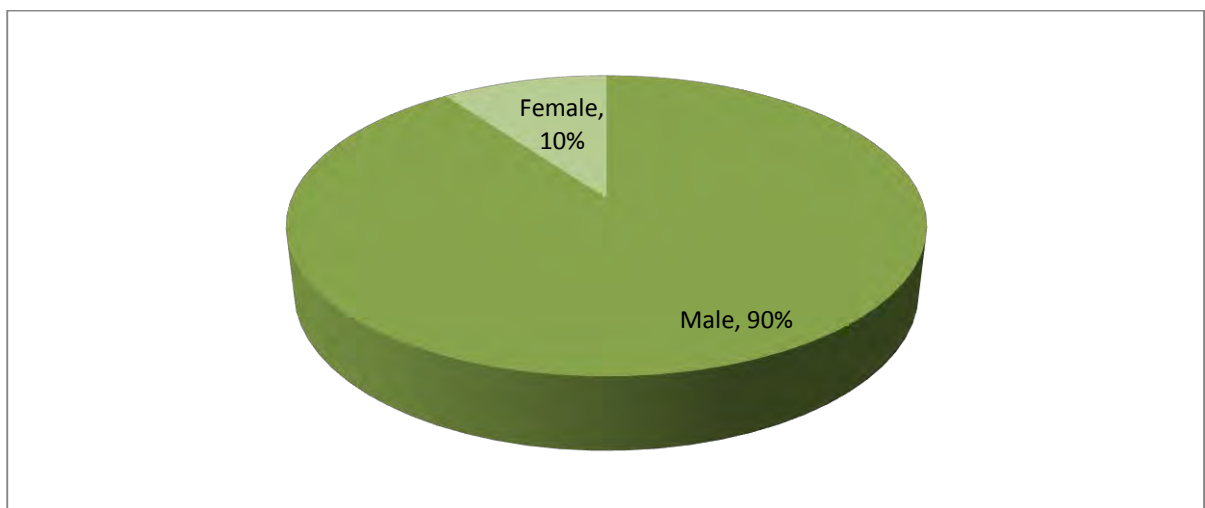
#### 4.0 Introduction

This chapter addresses the research questions in chapter one with discussions on the findings from the research. Statistical Package for Social Sciences (SPSS.16) was employed for the analysis of the Factors that causes road Construction Delays. Chi-Squared Test was used to determine the significance of the variables. Finally, the Relative Importance Index (RII) was also employed to rank the significance of variables. The next section of the study addresses the demographic characteristics of respondents.

#### 4.1 Demographic Characteristics of Respondents

Gender of respondents is a demographic characteristic of the respondents that was assessed during the study. Data was generated to describe the representation of male and female respondents. Analysis of data on the representation of male and female respondents in the study was reflected by the results as contained in Figure 4.1 below.

**Figure 4.1: Gender Analysis of Respondents**



**Source:** Field Data, 2015

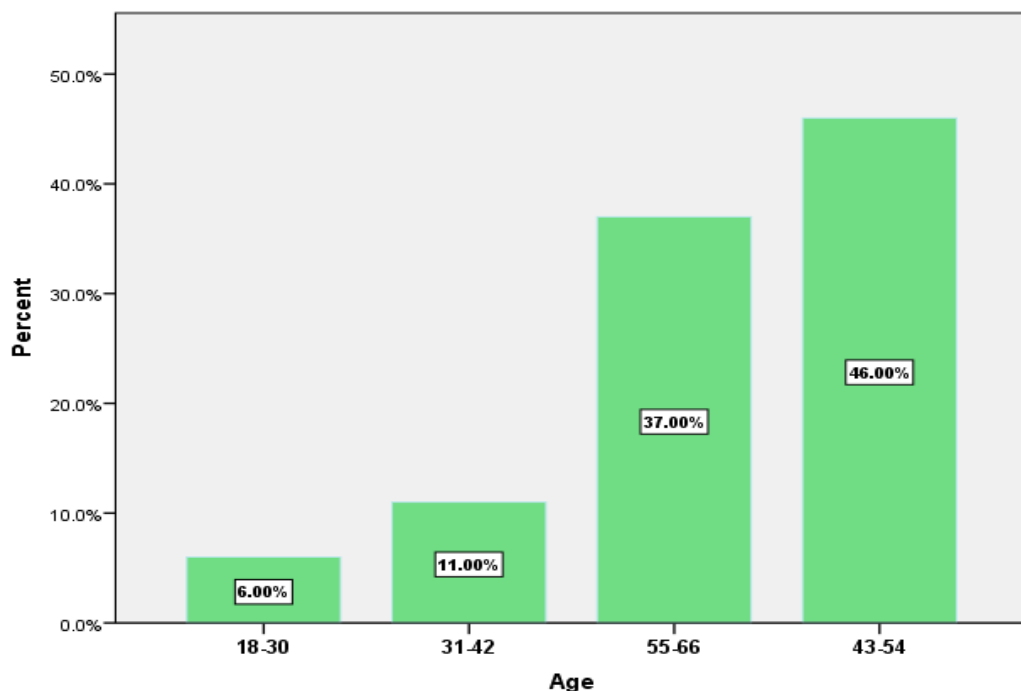
### 4.1.1 Gender Analysis of Respondents

As per the results contained in Figure 4.1 above, a proportion of 90% of the studied respondents were male while 10% of them were females. This shows that even though there is gender representation in the study, but the majority of the respondents constituted males. The implication of these results is that the responses generated by the study were likely to have been influenced by the dominant views of the male respondents. However, there were gender considerations and that by virtue of the nature of target population, male dominated the responses. In effect, the survey results on figure 4.1 showed that the contractors, client, architects, engineers and other key staffs in the construction sector, males are more dominant.

### 4.1.2 Age of respondents

Age distribution of respondents is another demographic characteristic of the respondents who participated in the study. During the study, data was gathered on the ages of respondents who participated in the study. The import of such was to establish the age categories of respondents who participated in the study. The results on the age distribution of respondents are presented in figure 4.2 below.

**Figure 4.1.2: Age Analysis of Respondents**



**Source:** Field Data, 2015

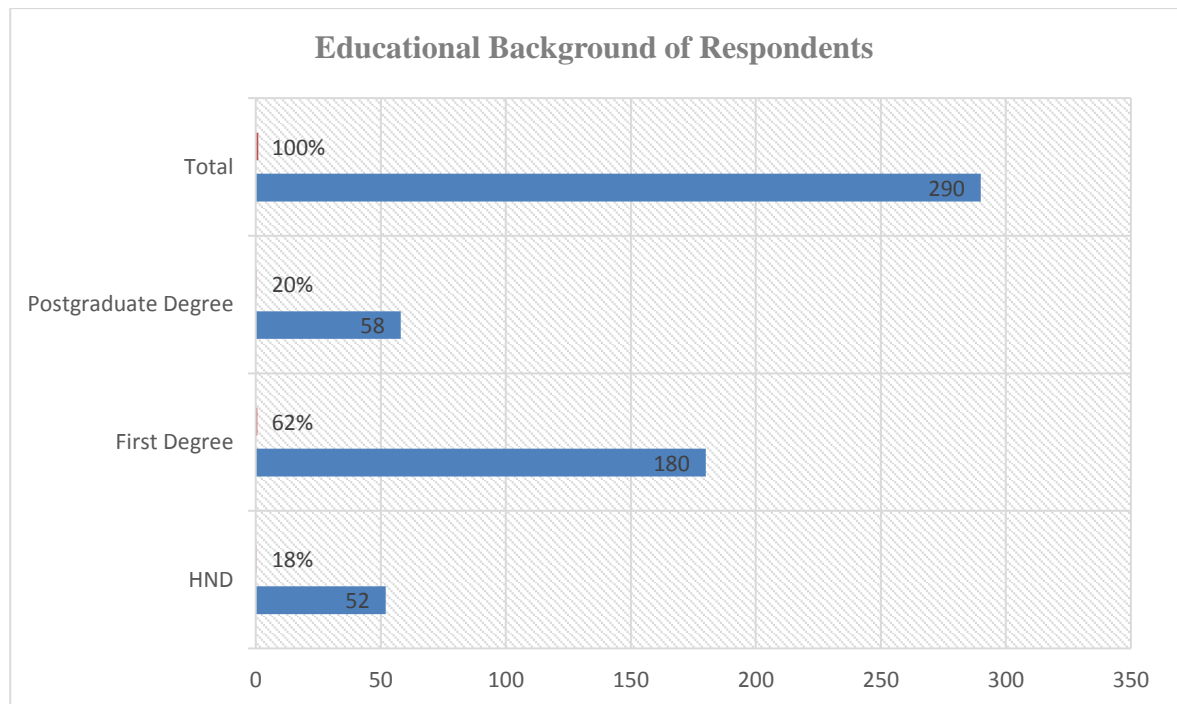
The results in Figure 4.2 showed the age distribution of sampled respondents. According to the results, a majority of the 46% of respondents sampled was aged between 43-54 years. This is followed by 37% with an age range of between 55-66 years. The age range of 31-42 years accounted for 11% while the age of 18-30 years accounted for 6% of total responses.

This shows that the key players in the road construction sector in Ghana have their age range between 42-66 years and thus have a significant level of experience in this field of expertise and are thus able to provide response necessary to attain the research objectives and delve into root causes of delays in road construction in Ghana.

#### **4.1.3 Educational Background of respondents**

Educational background was another background characteristic of the respondents who participated in the study. The import of this section was to assess the educational background of the respondents. It is obvious that educational background of a respondent could influence the pattern of responses of such a respondent especially on a study of this type. Hence, the data was gathered to determine the educational background of the study respondents. The results of the study are presented in Figure 4.3 below.

Figure 4.3: Educational Background of Respondents



Source: Field Data, 2015

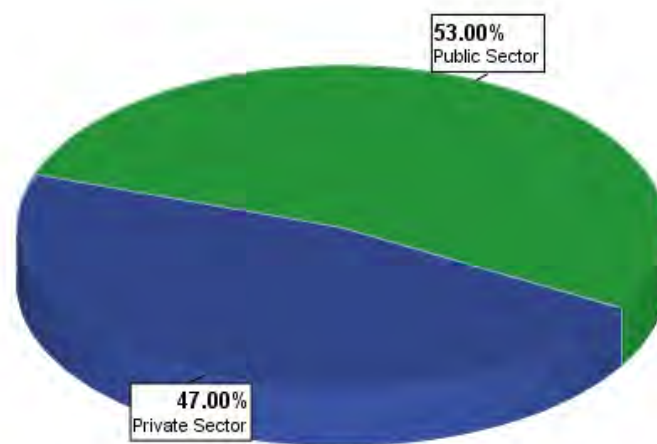
The results contained in Figure 4.3 showed that significant percentages (62%) of the respondents sampled during the survey have attained educational levels up to the first-degree level. This was followed by those with post-graduate degrees who accounted for 20% of respondents as well as those with the key technical education, that is, HND accounting for 18% of the sampled data.

The educational level of respondents within the context of this study is very important in order to combine both experience and education to address the systemic causes of delay in road construction projects in Ghana. They will thus be able to identify the intricacies of the road construction sector be it from within the public or the private sector.

#### 4.1.4 Sectoral distribution of respondents

Sectoral distribution of the respondents was yet another demographic feature of the respondents that was addressed by the study. The import of this part of data was to determine the distribution of the respondents over the sectors that participated in the study. The results generated are presented in Figure 4.4 below.

**Figure 4.1.4: Sectoral Distribution of Respondents**



**Source:** Field Data, 2015

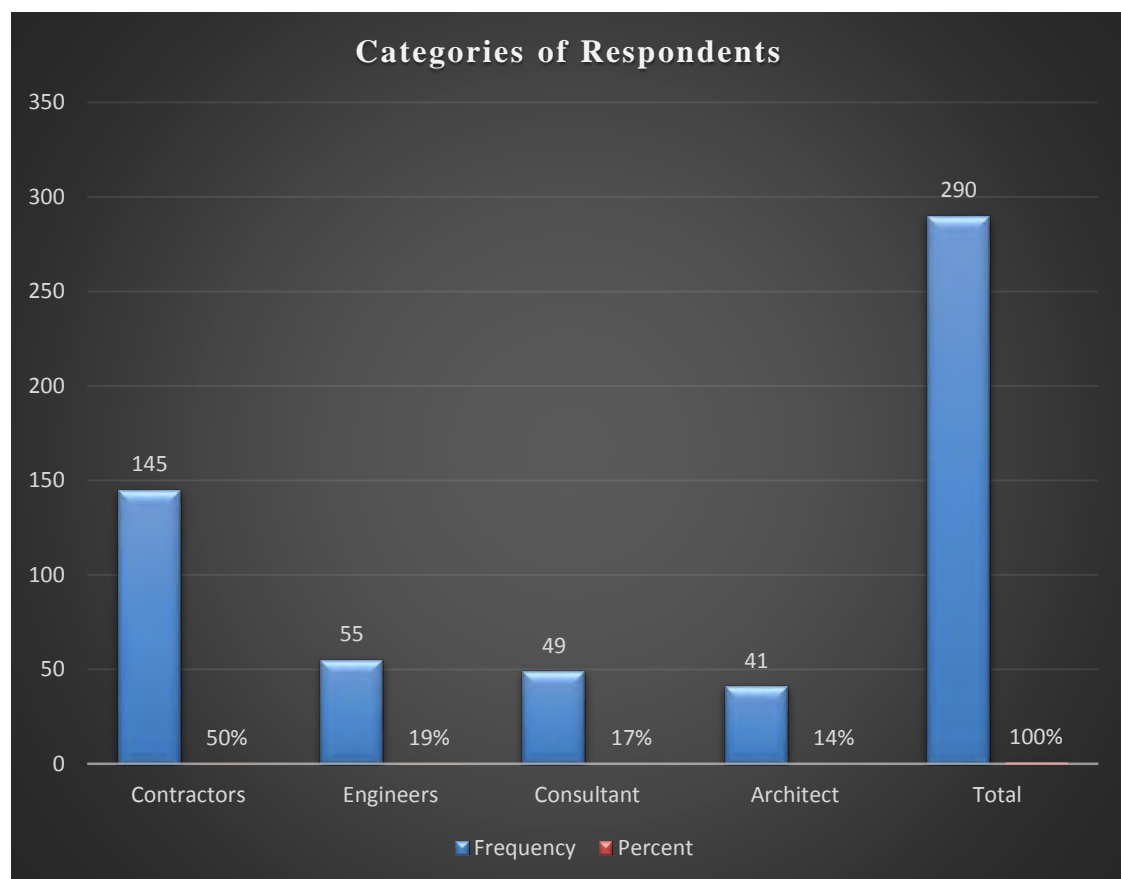
The results in figure 4.4 showed that 53% of respondents who participated in the study were from the public sector, mainly from the Regional Coordinating Councils, Ministry of Roads and Highways, Ministry of Finance and Economic planning, Ghana Highway Authority, Department of Urban Roads, and Department of Feeder Roads. Whereas the private sector respondents constituted 47% of the responses. These categories of respondents were drawn from contractors, architects, and other private sector engineers.

The results showed that there was an effective participation of respondents from the public and private sector. The implication of these results is that the views, opinions, and experiences of the respondents were inclusive of varied actors from the public and private sectors making the findings of the study very comprehensive.

#### 4.1.5. Categories of Respondents

Another variable that was addressed by the study is the categories of respondents who participated in the study. Various categories were contacted during the study aimed at generating information that was relevant to the study objectives. Results on the details of the categories of respondents are presented in Table 4.2 below.

**Figure 4.1.5: Category of Respondents**



**Source:** Field Data, 2015

As indicated in Figure 4.5 above, out of the total categories of respondents who participated in the study, 50% were contractors who were workers within the

Department of Urban Roads and were identified as those who had the mandate to construct and monitor the activities of urban road construction projects for the Government of Ghana. Engineers and Consultants within the context of the road construction sector in Ghana are synonymous and constitute 19% and 17% respectively. Within the context of this study also, they are both private sector operators. Architects constitute 14% of total responses. Any delay in major or minor road construction projects emanate from these respondents as such the equitable administration of the questionnaires to these categories of respondents helped the researcher to conduct detailed root cause analysis of the delays that occur during the Ghanaian public road construction projects.

#### **4.2. Causes of Delays on Execution of Construction Projects**

This section of the study discusses the results and findings on the causes of delays in the execution of construction projects of the Department of Urban Roads (DUR) in Greater Accra and Ashanti Regions of Ghana. Details of the results on the causes of the delays in execution of construction projects of the Department of Urban Roads are contained in Table 4.1 below.

**Table 4.2: Causes of Delays in Execution of Construction Projects of DUR**

Causes of Delays in Execution of Construction Projects	N	Mean
Improper planning of contractor during bidding stage	290	4.3586
Low cash flow to complete the project	290	4.3586
Financial constraints of contractors	290	4.1897
Ambiguity in specifications and conflicting interpretation by parties	290	3.8966
Delay in material procurement by contractor	290	3.8621
Delay in running bill payments to the contractor	290	3.7069
Lack of motivation for contractors to early finish	290	3.6897
Lack of skilled technical personnel	290	3.6552
Non availability of drawing/design on time	290	3.6379
Inadequate experience of contractor	290	3.5862
Unrealistic time schedule imposed in contract	290	3.5586
Obtaining permission from local authorities	290	3.5483
Poor labor productivity	290	3.4483
Lack of project planning	290	3.3103
Poor site management	290	3.1621
Poor contract management	290	2.9655
Changes in government regulations and laws	290	2.9414

Poor means of contracting	290	2.8276
Rework due to error in execution	290	2.7000
Lack of communication among project actors	290	2.3966
Slow decisions from Client	290	2.3103
Delays in the supply of raw materials	290	2.2069
Delay in material delivery by vendors	290	2.0724
Rework due to change of design or variation order	290	2.0345
Extreme weather conditions	290	1.9172
Restricted access at site	290	1.7966
Valid N (list wise)	290	

**Source:** Field Data, 2015

Table 4.1 contains results on the causes of delays in execution of construction projects of the Department of Urban Roads (DUR) in Greater Accra and Ashanti Regions of Ghana. Column 1 of Table 4.1 shows the identified causes that are responsible for delays in executing road construction projects of DUR in Ghana. These causes were identified and rated by the respondents using a Likert scale of 1-5, where 5 =Very High, 4 = High, 3 = Neutral, 2 = Low, 1 = Very Low. The mean values generated by the study results as contained in Table 4.1 showed the average responses of the respondents on the rating of the causes of delays in executing construction projects.

On the average, the study revealed three most prominent factors that cause delays in road construction projects of DUR. These prominent factors are improper planning by contractors during bidding (4.3586), low cash flow to complete projects (4.3586) and financial constraints of contractors (4.1897). These three factors were rated high in terms of their contribution to causes of delays in the execution of road construction projects of DUR in Ghana. The three factors had the highest mean values reflecting the extent of their contribution as construction project delays factors.

In addition, the second category of factors identified and rated by respondents includes the following:

- delay in material procurement by contractor;
- ambiguity in specifications and conflicting interpretation;
- lack of motivation for contractors to early finish;
- lack of skilled technical personnel;
- non-availability of drawing/design on time;
- inadequate experience of contractor;
- delay in running bill payments to the contractor;
- unrealistic time schedule imposed in contract;
- obtaining permission from local authorities;
- poor labor productivity; and
- Lack of project planning and poor site management.

These categories of factors were described by respondents as no real causes of delays in road construction projects of DUR in Ghana. The respondents were neutral and indecisive in their rating of these categories of factors as real causes of delays in road construction projects of DUR in Ghana. Each of these categories of factors as contained in Table 4.1 were rated and revealed to have mean values of 3. The implication of this mean values is that respondents were neutral in their responses on rating them as real causes of delay in road construction projects of Department of Urban Roads.

Another group of factors of delays was rated by respondents in terms of its applicability as causes of delays in executing road construction projects in Ghana. These causes include; poor contract management, changes in government regulations and laws, poor means of contracting, rework due to error in execution, lack of communication among project actors, slow decisions from client, delays in the supply of raw materials, delay in material delivery by vendors as well as rework due to change of design or variation order. The mean values of each of these causes were revealed to be 2. The implication of this results is that each of those causes were rated low, meaning that there were minor causes of delays in executing construction projects.

Finally, another group of causes was identified to be very low in terms of rating of respondents. This group of causes had mean values of 1. This implied that their influence on the delays in executing construction projects is minor. These causes were identified as extreme weather conditions and restricted access at the site.

#### **4.2.2 Relative Importance Index of Causes of Delays**

Upon generating the mean values of factors that cause delays in executing the construction projects of the Department of Urban Roads, further, data was generated to assess the Relative Importance Index (RII) for each of the factors. The results of RII for the cause factors are presented in Table 4.2 below.

**Table 4.2.2: Relative Importance Index of Factors**

Factors that cause delay in road construction projects	Responses <sup>1</sup>						Total	RII	Rank
	SD	D	U	A	SA				
Low cash flow to complete the project	0.0	0.0	0.0	64.1	35.9		100.0	0.87	1
Financial constraints of contractors	1.4	7.2	6.9	40.0	44.5		100.0	0.85	2
Ambiguity in specifications and conflicting interpretation by parties	0.0	0.0	41.4	27.6	31.0		100.0	0.78	3
Lack of skilled technical personnel	5.9	0.0	31.4	48.3	14.5		100.0	0.77	4
Delay in material procurement by contractor	15.5	12.1	0.0	15.5	56.9		100.0	0.76	5
Delay in running bill payments to the contractor	0.0	0.0	41.4	46.6	12.1		100.0	0.75	6
Lack of motivation for contractors to early finish	15.5	0.0	0.0	69.0	15.5		100.0	0.74	7
Non availability of design on time	0.0	9.3	17.6	73.1	0.0		100.0	0.73	8
Unrealistic time schedule of contracts	0.0	11.4	31.4	47.2	10.0		100.0	0.71	9

<sup>1</sup> Strongly Agree (SD); Disagree (D); Undecided (U); Agree (A) & Strongly Agree (SA).

Inadequate experience of contractor	12.1	31.0	0.0	0.0	0.0	56.9	100.0	0.7	10
Poor labor productivity	15.5	0.0	24.1	44.8	15.5	100.0	100.0	0.69	11
Improper planning of contractor at bidding	0.0	0.0	0.0	64.1	35.9	100.0	100.0	0.67	12
Lack of project planning	0.0	33.1	2.8	64.1	0.0	100.0	100.0	0.66	13
Poor site management	32.1	4.1	1.0	41.0	21.7	100.0	100.0	0.64	14
Rework due to change of design or variation	36.9	41.4	7.2	10.3	4.1	100.0	100.0	0.63	15
Delays in the supply of raw materials	54.5	7.9	0.0	37.6	0.0	100.0	100.0	0.59	16
Poor contract management	27.6	31.0	0.0	41.4	0.0	100.0	100.0	0.58	17
Poor means of contracting	0.0	58.6	0.0	41.4	0.0	100.0	100.0	0.56	18
Rework due to error in execution	11.7	46.9	3.1	36.2	2.1	100.0	100.0	0.53	19
Lack of communication among project actors	31.7	33.1	1.0	32.1	2.1	100.0	100.0	0.47	20
Slow decisions from Client	24.5	47.6	8.3	11.7	7.9	100.0	100.0	0.46	21
Obtaining permission from local authorities	10.7	.7	41.7	16.9	30.0	100.0	100.0	0.44	22
Delay in material delivery by vendors	54.8	19.3	3.1	9.3	13.4	100.0	100.0	0.41	23
Restricted access at site	63.8	19.3	0.0	7.2	9.7	100.0	100.0	0.4	24
Extreme weather conditions	67.2	7.9	2.1	11.4	11.4	100.0	100.0	0.38	25
Changes in government regulations and laws	2.1	36.2	43.4	2.1	16.2	100.0	100.0	0.36	26

**Source:** Field Data, 2015

The results in the highlighted column in Table 4.2 above are the RII values for the identified factors that cause delays in execution of construction activities of the Department of Urban Roads in Greater Accra and Ashanti Regions of Ghana. The Relative Important Index (RII) of every factor that causes a delay in road construction projects was generated from the data. Table 4.2 above shows the results on each of the factors. The priority for each factor was decided from the views held by the respondents, whether or not every factor fits to be given level 1 to 5, as stated in the study. The overall RII that was obtained as shown in the table above reflects on the factors that affect road construction projects more. In this study, a large RII value is very important in the analysis and the small value would be on the contrary. “Low cash flow to complete the project” had the highest RII value of 0.87 in the study and “Changes in government regulations and laws” had the lowest RII value of 0.36.

Out of the twenty-six (26) factors of delay analyzed, nineteen (19) of them have RII values above 0.5. These delay factors are:

- Low cash flow to complete the project,
- Delay in material procurement by contractor,
- Financial constraints of contractors,
- Ambiguity in specifications and conflicting interpretation by parties,
- Lack of skilled technical personnel,
- Delay in running bill payments to the contractor,
- Lack of motivation for contractors to early finish,
- No availability of drawing/design on time,
- Inadequate experience of contractor,
- Unrealistic time schedule imposed in contract,
- Poor labor productivity,
- Improper planning of contractor during bidding stage,
- Lack of project planning,
- Poor site management,
- Rework due to change of design or variation order,
- Delays in the supply of raw materials,
- Poor contract management,
- Poor means of contracting, and

- Rework due to error in execution.

The above-mentioned delay factors have been found to be among the most critical road construction project delay contributors in Ghana and this is confirmed by their high RII value as obtained by this study. Though they are contributors to delays, the other seven (7) factors are found to low effect on construction project delays as compared to the nineteen (19) of them whose RII values are above 0.5.

#### **4.3 Effects of Delays on Execution Processes of Construction Projects**

The effects of delays in the execution of construction projects of Department of Urban Roads (DUR) in Greater Accra and Ashanti Regions of Ghana are yet another objective area of the study. As part of the set out objectives of the study, data was gathered to analyze how the delays affect the execution of construction projects under the Department of Urban Roads. The results generated from Likert scale ratings of respondents on how the delays in executing construction activities affect the project are presented in Table 4.3 below.

**Table 4.3: Effects of Delays on Construction Projects**

Effects of Delays in Executing Construction Projects	Frequency and Percent Responses on Likert Scale Rating of Effects					Σr	RII	Position
	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)			
1. Delays in construction execution leads to rework financing problems	40 (13.8%)	9 (3.1%)	11 (3.8%)	230 (79.3%)	0 (0%)	1011	0.6972	5th
2. Delays in construction execution leads to reduction in value of moneys for construction	0 (0%)	25 (8.6%)	26 (9%)	26 (9%)	213 (73.4%)	1297	0.8945	4th
3. Delays in construction execution reduces quality and Standardization of projects	0 (0%)	28 (9.7%)	17 (5.9%)	17 (5.9%)	228 (78.6%)	1315	0.9069	3rd
4. Elongation of project duration	19 (6.6%)	0 (0%)	11 (3.8%)	32 (11%)	228 (78.6%)	1320	0.9103	2nd
5. Delay had significant effects on actual project duration.	0 (0%)	19 (6.6%)	11 (3.8%)	9 (3.1%)	251 (86.6%)	1362	0.9393	1st

**Source:** Field Data, 2015

Results contained in Table 4.3 showed the responses from sampled respondents who participated in the study. The frequency and percent of responses were generated from the data of the study as Likert ratings of how construction projects are affected by delays in execution of activities. The highlighted portions in Table 4.3 showed majority view on each of the effects of delays on construction evaluated by the study. The study revealed that out of 290 who were contacted as respondents during the study, 230 of them agree that delays in construction execution lead to rework financing problems. This number of respondents represents 79.3% of the entire respondents who were interviewed for the study. In addition, 213 respondents representing 73.4% of the total sample strongly agree that delays in executing construction activities lead to a reduction in value of money for completion of projects. This implies that time value of money changes over time and once delays set in, the time value of the money may reduce affecting the amount of task that possibly will be executed.

Furthermore, delays in executing construction projects were also revealed by the study to have adversely affected construction projects by reducing the quality and standardization of projects. This was strongly agreed by a majority of respondents (228) representing 78.6% of the total sample. As much as resources are not forthcoming, contractors may decide to do mediocre work in the name of economizing resources towards meeting individual interests. This usually compromises the standards and quality of work.

More so, the same proportion of respondents constituting the majority (228) representing 78.6% strongly agreed that the delays affect construction projects by elongation of project duration. There is the tendency of even increasing the costs of projects because of time extension and possibilities of reduction in the money value.

Finally, it was revealed by the study that 86.6% of the respondents constituting the majority strongly agreed. This indicates that delays in executing construction projects have significant effects on actual project execution especially the duration and content of the project are usually changed. The implication of these findings is that the opportunity cost of delays in executing construction projects is the elongation of project duration, reduced standardization, and reduced quality.

### **4.3.1 Correlation of Effects of Delays on Construction Projects**

In addition, further analysis was carried out to show the correlation of the effects of delays on construction projects. The Spearman Correlation was employed in this analysis. Details of the results generated from the Spearman Correlation analysis are presented in Table 4.4.

**Table 4.3.1: Correlation of Effects of Delays on Construction Projects**

Spearman's rho		Rework financing problems	Reduction in Value for money	Reduced quality and standardization	Elongation of Project Duration	Loss and expense claims
Effects: Rework financing problems	Correlation Coefficient	1.000	.898**	.693**	.677**	.735**
	Sig. (2-tailed)	.	.000	.000	.000	.000
	N	290	290	290	290	290
Effects: Reduction in Value for money	Correlation Coefficient	.898**	1.000	.859**	.864**	.695**
	Sig. (2-tailed)	.000	.	.000	.000	.000
	N	290	290	290	290	290
Effects: Reduced quality and standardization	Correlation Coefficient	.693**	.859**	1.000	.994**	.819**
	Sig. (2-tailed)	.000	.000	.	.000	.000
	N	290	290	290	290	290
Effects: Elongation of Project Duration	Correlation Coefficient	.677**	.864**	.994**	1.000	.812**
	Sig. (2-tailed)	.000	.000	.000	.	.000
	N	290	290	290	290	290
Effects: Loss and expense claims	Correlation Coefficient	.735**	.695**	.819**	.812**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.
	N	290	290	290	290	290

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

Source: Field Data, 2015

Table 4.4 contains results of Spearman Correlation analysis. As indicated, results that are indicated and marked with double asterisk showed that the correlation coefficient of that variable is significant. The interpretation of the results revealed that each of the effects of delays in executing construction projects is significantly correlated at 0.01 level using 2-tailed correlation analysis. The implication of these results is that the effects of delays on road construction projects (i.e. rework financing problems; reduction in value for money; reduced quality and standardization; elongation of project duration as well as loss and expense claims) are significantly related to each other.

#### 4.4 Strategies to Avert Delays in Construction Projects

This section of the study that addresses one objective of the study. Data was gathered on the types of strategies that could be adopted to avert the delays in executing construction projects in Ghana. Results generated from analysis of data that were generated through the Likert scale of 1-5 are presented in Table 4.5 below.

**Table 4.4: Strategies to Advert Delays in Executing Construction Projects**

Strategies to Avert Delays in Executing Construction Projects	N	Mean	Ranking
Adequate understanding of contractors on project task	290	4.4586	1 <sup>st</sup>
Effective mobilization and release of resources	290	4.3724	2 <sup>nd</sup>
Early engagement of project managers	290	4.3310	3 <sup>rd</sup>
Adequate and effective supervision	290	4.10	4 <sup>th</sup>
Strategies: Ensure adequate training of project staff	290	3.28	5 <sup>th</sup>
<b>Valid N (list wise)</b>	<b>290</b>	<b>20.542</b>	-

**Source:** Field Data, 2015

As shown in Table 4.5 above, the views of respondents were gathered on the strategies that are available to avert delays in executing construction projects. Using a five-point Likert scale where; 1=strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree and 5=Strongly Agree, respondents were made to rate their agreement to each of these strategies in terms of their applicability to the context of the study. Analysis of the

responses gathered revealed that apart from ensuring adequate training for project staff on specific requirements of construction projects on which respondents were undecided in their rating represented by a mean value of 3.28. The rest of the strategies such as; adequate understanding of contractors on project task, effective mobilization and release of resources, early engagement of project managers as well as adequate and effective supervision of construction activities were each identified and agreed to them as strategies that are applicable and feasible to avert the delays in executing construction project activities. Each of these strategies was revealed by the study to have mean values of 4 and above. This justifies the agreement and acknowledgement of the applicability of these strategies.

#### **4.4.1 Chi-Square Test of Strategies to Avert Construction Delays**

In addition to identifying, rating, and ranking the strategies that will avert delays in executing construction projects, further analysis was carried out to conduct a chi-square test on each of the strategies. The chi-squared test was used in establishing the significant difference between the observed frequencies and the expected frequencies in the categories of strategies avert delays in executing construction projects. The results of Chi-Square Test are presented in Table 4.6 below.

**Table 4.4.1: Chi-Square Test of Strategies**

Test Variables	Ensure adequate training of staff on the specific projects	Adequate and effective supervision	Early engagement of project managers	Effective mobilization and release of resources	Adequate understanding of contractors on project task
Chi-Square	60.241 <sup>a</sup>	275.621 <sup>a</sup>	191.628 <sup>b</sup>	214.800 <sup>b</sup>	276.869 <sup>b</sup>
Df	4	4	3	3	3
Asymp. Sig.	.000	.000	.000	.000	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 58.0.

b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 72.5.

Upon conducting a Chi-Square Test of the strategies for averting the delays in construction projects, the results showed two categories of strategies. Two of the strategies thus ensuring adequate training of project staff and adequate and effective supervision had a minimum expected cell frequency of 58.0. Meanwhile, the Chi-Square Test results revealed that the observed frequencies of each of these two strategies were greater than the minimum expected cell frequency of 58.0 with a degree of freedom of 4 each. Whereas, the second categories of strategies, that is, early engagement of project managers, effective mobilization, and release of resources as well as contractors' adequate understanding of project content and requirements were revealed to have expected frequencies less than 5. However, the minimum expected cell frequency of these strategies is 72.5 with a degree of freedom to be 3. The observed frequencies of each of these strategies were revealed greater than the minimum expected cell frequency of 72.5. The results on expected frequencies and observed frequencies of all the strategies implied that there is an asymptotic significant difference between the strategies identified to avert delays in executing construction projects in Ghana (See Table 4.6).

#### **4.5 Conclusion**

This chapter addresses the discussion of data that was gathered on the objectives of the study. The analysis was done and presented on the themes of the objectives. The focus of the chapter includes; causes of delays in executing construction projects, effects of delays on the construction projects, and strategies to avert the delays in executing construction projects. The objectives were comprehensively addressed and presented by this chapter through the application of basic statistical tools such as; correlation, descriptive, frequencies and chi-square tests.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter presents the summary of major findings of the study. It also addresses the conclusion and recommendations that were generated from the findings of the study. The summary of the study findings is presented in the next section.

#### 5.2 Summary of Major Findings

This section presents the summary of the study findings that form the core of each of the objectives of the study. Generally, this study addressed three main objectives. Thus, the study :

- Set out to investigate the causes of delays in executing construction projects.
- Also aimed at assessing how the delays in project execution affect construction projects.
- To explore the strategies that could be used to avert delays in executing construction projects.

On the causes of delays in executing construction projects, it was revealed by the study that several factors account for the delays in executing construction projects in Ghana. That, improper planning on the part of contractors during bidding, low cash flow to complete projects and the lack of financial capacity on the part of the contractors were rated high in terms of the causes that delay execution of construction projects by the Department of Urban Roads. The above-mentioned causes had average mean values of 4.3586, 4.3586, and 4.1897 respectively. The causes of delays in executing construction projects were found to include:

- ambiguity in specifications and conflicting interpretation,
- delay in material procurement by the contractor,
- delay in running bill payments to the contractor,
- lack of motivation for contractors to early finish,
- lack of skilled technical personnel,

- non-availability of drawing/design on time,
- inadequate experience of contractor,
- unrealistic time schedule imposed in contract,
- obtaining permission from local authorities,
- poor labor productivity,
- lack of project planning, and
- poor site management
- poor contract management,
- changes in government regulations and laws,
- poor means of contracting, rework due to error in execution,
- lack of communication among project actors,
- slow decisions from client,
- delays in the supply of raw materials,
- delay in material delivery by vendors,
- extreme weather conditions and restricted access at site , and
- Rework due to change of design or variation order.

These factors were indicated as accounting for delays in executing construction projects in Ghana. It was later revealed by the study that extreme weather conditions and restricted access at site were also contributory causes to delays in execution of construction projects.

In terms of how the delays in execution of construction projects affect the construction projects in general, it was observed by the study that out of 290 respondents contacted during the study, 230 of them agree that delays in construction execution lead to rework financing problems. In addition, 213 respondents representing 73.4% of the total sample strongly agree that delays in executing construction activities led to a reduction in the value of money received as payments for projects completed. Furthermore, delays in executing construction projects were also revealed by the study to have adversely affected construction projects by reducing the quality and standardization of projects. This was strongly agreed to by the majority of respondents (228) representing 78.6% of the total sample. More so, the same proportion of respondents constituting the majority (228) representing 78.6% strongly agreed that the delays affect construction

projects by elongation of project duration. Finally, it was revealed by the study that 86.6% of the respondents constituting the majority strongly agreed. This indicates that delays in executing construction projects have significant effects on actual project execution especially the duration and content of the project are usually changed. The implication of these findings is that the opportunity cost of delays in executing construction projects is the elongation of project duration, reduced standardization, and reduced quality.

In searching for the way forward, the study explored strategies that could be adopted in averting the delays in executing construction projects. The study found that apart from ensuring adequate training of project staff on specific requirements of construction projects on which respondents were undecided in their rating represented by a mean value of 3.28. Other strategies such as; educating the contractors to aid them to adequately understand project task, effective mobilization and release of resources, early engagement of project managers as well as adequate and effective supervision of construction activities were each identified and agreed as strategies that are applicable and feasible to avert the delays in executing construction project activities. Each of these strategies was revealed by the study to have mean values of 4 and above. This justifies the agreement and acknowledgement of the applicability of these strategies.

### **5.3 Conclusion**

The objectives of the study were to investigate the causes of delays in executing construction projects, effects of such delays on construction projects and propose strategies to mitigate and avert the delays in executing construction projects in Ghana. It is worth acknowledging that several factors account for the delays in executing construction projects. The concomitant effects of the delays on construction projects that emerged from the study to include delays in project durations, cost overruns, reduced quality and standardization among others. The recommended strategies for averting the delays in executing construction projects include; adequate knowledge on the part of contractors on project task, effective mobilization and release of resources on the part of the clients, early engagement of project managers as well as an adequate and effective supervision of construction activities. When these strategies are

implemented, the situation of delays and its effects on road construction projects could be mitigated.

#### **5.4 Recommendations**

This section of the study presents the suggestions that were gathered by the researcher from the study. Upon analysing the responses gathered, certain inferences were drawn and other direct suggestions from respondents taken into consideration to arrive at the recommendations of the study. In the light of this, the under listed are some of the recommendation that were generated form the study .

1. The issue of resourcing of projects emerged strongly from the study as a delay factor that poses several challenges as revealed by the study. The need for the review of resourcing strategy of construction projects is a critical aspect that could enhance the timely execution of construction projects in Ghana.
2. In addition, professional competency and understanding of project demands are required at the early stages of contract advertisement, bidding and awarding. When these variables are taken seriously, competent contractors with the requisite experience and capacity will be selected for contracts. This implies that issues of competency and poor understanding of contract requirements will be outdated.
3. Bureaucracy in administrative systems in Ghana is yet another area of concern. This system poses a great challenge in going through public offices in Ghana. It contributes to most of the delays in the release release of both resources and directives of which handling construction projects is no exception. The bureaucratic structures in our public offices need urgent attention because it affects most service delivery and delays decision-making processes in Ghana.
4. Intensifying the monitoring and supervision system of construction genuinely is much needed. Devoid of any form of bribery and influences, this will enhance construction projects execution in Ghana. Professionalism must be the driving force around which operations in the construction sector revolves. There have

been many influences in the public construction sector. Hence, revitalizing sanity and professionalism will contribute to efficient delivery of construction projects in Ghana.

### **5.5 Suggestions for Future Research**

Upon discussion of findings on the objectives of the study, critical assessment of future research needs was effected aimed at offering suggestions for research. The following are the suggestions for future research.

1. Further research on the impact of politicians on the construction projects especially government-sponsored construction projects is very relevant in view of the growing recognition of what influence peddling does to the quality of projects in developing countries like Ghana.
2. Detail study on the procedures and selection processes of contractors taking into consideration political, ethnic, and regional via professional demand of construction projects.

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## **APPENDIX: 1**

### **QUESTIONNAIRE FOR ACTORS IN THE CONSTRUCTION SECTOR OF GHANA**

#### **PROJECT TOPIC: ASSESSING THE CAUSES AND EFFECTS OF DELAYS IN ROAD CONSTRUCTION INDUSTRY IN GHANA**

DEAR SIR/MADAM,

THIS QUESTIONNAIRE WAS DESIGNED BY THE RESEARCHER TO SOLICIT INFORMATION FOR A RESEARCH WORK BEING UNDERTAKEN TO ANALYZE THE DELAYS IN CONSTRUCTION PROJECTS IN GHANA THROUGH A SYSTEMS APPROACH WITH FOCUS ON THE DEPARTMENT OF URBAN ROADS IN GHANA. THE RESEARCH IS PURELY FOR ACADEMIC PURPOSES. IT IS THEREFORE GUARANTEED THAT THE INFORMATION SO GRANTED OR PROVIDED SHALL BE TREATED WITH UTMOST CONFIDENTIALITY. THANK YOU FOR YOUR HELP.

#### **SECTION A: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS**

##### Background information

1. Sex of respondents a. Male b. Female
2. Age of respondents a. 18-30 b. 31-42 c. 43-54 d. 55-66 e. 67+

##### Educational background

3. Educational Status of respondents a. First Degree b. Postgraduate Degree c. HND d. SSCE e. Other (specify).....

##### Institution of Employment

4. Which sector are you? a. Public Sector b. Private Sector

##### Employment Category

5. What category of operations are you engaged in? a. Engineer b. Contractor c. Consultant d. Architect e. Others (specify).....



6. What are the factors that cause delays in executing construction projects in Ghana? (Tick the most appropriate using a Likert scale of 5-1 where; 5 =Strongly Agree, 4 = Agree, 3 = Undecided, 2 = Disagree, 1 = Strongly Disagree in the table below).

S/No	Causes of Delays	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1	Slow decisions from Client					
2	Rework due to error in execution					
3	Financial constraints of contractors					
4	Poor contract management					
5	Delay in material procurement by contractor					
6	Ambiguity in specifications and conflicting interpretation by parties					
7	Inadequate experience of contractor					
8	Poor labour productivity					
9	Lack of motivation for contractors to early finish					
10	Poor means of contracting					
11	Lack of communication among project actors					
12	Poor site management					
13	Delay in material delivery by vendors					

14	Delay in running bill payments to the contractor							
15	Lack of skilled technical personnel							
16	Lack of project planning							
17	Non availability of drawing/design on time							
18	Unrealistic time schedule imposed in contract							
19	Extreme weather conditions							
20	Low cash flow to complete the project							
21	Improper planning of contractor during bidding stage							
22	Obtaining permission from local authorities							
23	Delays in the supply of raw materials							
24	Changes in government regulations and laws							
25	Restricted access at site							
26	Rework due to change of design or variation order							

7. How do the delay factors affect the construction projects of the Department of Urban Roads in Ghana? (Tick the most appropriate using a likert scale of 5-1 where; 5 =Strongly Agree, 4 = Agree, 3 = Undecided, 2 = Disagree, 1 = Strongly Disagree in the table below).

S/No	Effects of Delays	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1.	Delays in construction execution leads to rework financing problems					
2.	Delays in construction execution leads to reduction in value of moneys for construction					
3.	Delays in construction execution reduces quality and Standardization of projects					
4.	Elongation of project duration					
5.	Delay had significant effects on actual project duration.					

8. The table below is a list of strategies for averting the effects of delay factors on construction projects. Please rank these strategies in order of significance by ticking the appropriate boxes indicating the strategy suitable for averting effects of delays in Construction Projects in Ghana.

S/No	Strategies	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1.	Ensure adequate training of project staff					
2.	Adequate and effective supervision					
3.	Early engagement of project managers					
4.	Effective mobilization and release of resources					
5.	Adequate understanding of contractors on project task					

*Thank You*