EVALUATING THE CAUSES OF DELAYS IN THE CONSTRUCTION OF TELECOMMUNICATION TOWERS IN GHANA

By

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution, except where due acknowledgment is made in the thesis.

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ABSTRACT

The phenomena of delayed delivery of tower sites in Ghana is widespread. This characteristic overtime has crept to alarming proportions and likely to worsen as field competition by MNO's, regulatory and other factors impact the industry. To explore these phenomena of delays in the delivery of telecommunication towers in Ghana, this study identified causes of delays in the construction of telecommunication towers and identified and offered remedies that can be adopted to address delays as its objectives. A Likert scale type questionnaire was administered, and the data gathered was analysed using the Relative Importance Index (RII) to establish their importance. Results observed from the study were unrealistic contract duration imposed by clients, neighbourhood agitations, slow granting of permits by the regulators, poor monitoring and controlling, delays in honouring payment certificates, lack of tower materials in the local markets/construction materials, contractor's financial difficulties and escalation of material prices and project management problem contributed significantly to the delays. In conclusion the study came out with remedies that can be adopted to address delays in the construction of telecommunication towers to include, reducing the bureaucratic channels and processes that contractors go through before their certificates are honoured, adequate allocation of contingency funds to take care of inflation and price fluctuations, regulatory bodies to make the permitting process and requirements very clear to facilitate timely acquisition of relevant permits, initiation of prompt payments, contractors to ensure that there is adequate construction planning and monitoring the quality of activities continuously, purchasing of materials in bulk or look for very good local substitutes of construction materials and engaging experienced subcontractors with good reputation to undertake the construction of the telecommunication towers.This study is thus supposed to assist stakeholders in the construction of telecommunication towers in Ghana to enhance the effectiveness of the management of the telecommunication sector.

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LIST OF ABBREVIATIONS

1. BTF Build to Fill
2. BTS Build to Suit
3. CEO Chief Executive Officer
4. ISA‘s Individual Site Agreements
5. ISO International Organisation for Standardization
6. MLA Master Lease Agreement
7. MNO‘s Mobile Network Operators
8. NCA National Communication Authority
9. RII Relative Importance Index 10. Tower Co‘s Tower Companies

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DEDICATION

Firstly, I dedicate this piece of work to the Lord Almighty for his guidance, protection and seeing me through this study. Secondly, my dedication goes to my wife Mary Gibas for her understanding, encouragement and support throughout my study. Lastly, I dedicate this study to my lovey children Racquell Sibylla Ayinbono Anaba, Alexander Ayindenaba Anaba and Daniel Ayinsakiya Anaba (Junior) for their patience and support. I really appreciate it.

CHAPTER ONE

1.1 Background to the Study

The telecommunication industry plays an important role in all national economies including providing the base infrastructure and employment (Danso and Antwi, 2012). The telecommunication industry expands and achieves growth, spatially through the deployment of building new towers and upgrading of existing infrastructure. The dynamic and rapid evolution of technologies, the speed of deployment, upgrade of these infrastructure base and intensive rivalry among Mobile Network Operators (MNO‘s) make delays in telecommunication tower construction and deployment a critical concern and importance.

Construction delay is a major concern in the construction industry of which the telecommunication industry is not an exception. According to Hsu et al. (2017), a construction project is successful when it is completed on time, within budget and all relevant stakeholders are satisfied with its quality.

Azhar et al. (2008) indicated that there are several factors that affect the effective conclusion of projects on schedule, within budget and quality. Assaf and Al-Hejji (2006) further went on to acknowledge that delay is the most common, expensive and complex phenomenon faced in building construction projects and thus the need to understand the key delay causes and engineer justifiable solutions to take care of them.

Studies have revealed that construction projects experience delays and these delays are usually addressed by speeding up processes or extending the completion date (Rahsid et tal., 2013). Furthermore, Abd El-Razek et al. (2008) also recognised delay to be one of the most common problems in building construction projects that leads to several undesirable effects on projects and its partaking parties. In addition, it is a regular concern faced in the construction industry all over the world particularly in developing countries like Ghana. Delays are deceptive, normally leading to time and cost overruns, disagreements, litigation and complete desertion of projects (Sambasivan and Soon, 2007).

1.2 Problem Statement

The mobile telecommunication space in Ghana since 2007 has witnessed active market participation. The need to achieve the desired mobile penetration and accessibility as indicated in the national telecommunication policy document has resulted in competitive tendencies among Mobile Network Operators (MNO's) to capture the field. A long-term strategy adopted by the MNO's in the short term is through plans to deploy multiple telecommunication cell sites within the shortest time periods. This makes the deployment of telecommunication cell sites to be highly time driven. A key component in the deployment is the construction of the required support structure, tower, to host equipment for the deployment. This makes the construction of telecommunication towers in Ghana play an important role as it is also a contributor to the infrastructural development in the country. The highly time driven character of telecommunication cell sites make delays in their delivery invariably affect the technological advancement in the telecommunication industry in Ghana. The inability to keep pace with the demands to self-construct and deploy these infrastructures has motivated MNO's in Ghana to outsource the ownership and construction of these infrastructures (passive) to tower companies to enable them concentrate on their core business of providing telecommunication services. The network expansion and improvement of MNO's, therefore, depends solely on how speedily these tower companies make the tower infrastructures (passive) available.

Danso and Antwi (2012) who conducted a research on evaluating factors affecting time and cost overruns in telecommunication tower construction in Ghana indicated that telecommunication tower construction projects carried out between the period of 1992 and 2011 in Ghana experienced 82% of schedule delays.

The construction of telecommunication towers in Ghana is thus bedeviled with many issues that may be the root causes of delays in their construction. The above submissions therefore demanded the need to undertake this study to evaluate the causes of delays in the construction of telecommunication towers in Ghana.

1.3 Aim of the Study

The aim of this study is to evaluate the causes of delays in the construction of telecommunication towers in Ghana**.**

1.4 Research Objectives

In other to achieve the aim of the study, the objectives set to be covered included;

1. To identify the important causes of delays in the construction of telecommunication towers in Ghana.
2. To identify the important remedies that can be adopted to address delays in the construction of telecommunication towers in Ghana.

1.5 Research Questions

In other to meet the objectives of the study a set of questions were raised towards its achievement which included;

1. What are the important causes of delays in the construction of telecommunication towers in Ghana?
2. What are some of the important remedies that can be adopted to address delays in the construction of telecommunication towers in Ghana?

1.6 Significance of the Study

Delays in the construction of telecommunication cell sites in Ghana is a major problem. Whereas many studies have been conducted worldwide on causes of construction delays or causes of schedule delays in construction projects, (Durdyev et al. (2017); Famiyeh et al., (2017); Al-Kharashi and Skitmore (2009); Rachid et al. (2018) and Danso and Antwi (2012), currently there appears to be little studies highlighting the causes of delays in the construction of telecommunication towers in Ghana.

Although there have been studies in Ghana highlighting the most important causes of delays and its relations to the speed of project delivery in the telecommunication industry, the subject is worth exploring to further come out with new findings that may complement the work of other researchers in Ghana. This study may differ or be a complement to previous studies in that the sample population would involve only the Tower Construction Companies who are specialized in the construction and management of tower infrastructure as compared to other studies carried out using the entire telecom industry. The intent of this research was to undertake a study into the topic to come out with findings and recommendation as to the most important causes of delays in the construction of telecommunication towers in Ghana as well as to identify remedies that can be adopted to address the delays.

The findings of this study would help telecommunication infrastructure providers in planning efficiently for tower deployment as well as add to broaden knowledge on the causes of delays in telecommunication tower construction projects and most importantly it would also serve as a point of reference for future studies. This study would thus come out with findings which would help both infrastructure providers and Mobile Network Operators (MNO's) schedule their activities to meet their requirements on time. Accordingly, people from academia in general, will benefit immensely from this research work.

1.7 Scope of the Study

The study covered only the telecommunication tower companies (Tower Co's) in Ghana with the focus on the three main authorized tower companies; Eaton Towers, ATC Tower (GH) Limited and Helios Towers. These Telecommunication Tower Companies are authorized by the National Communication Authority to construct and own telecommunication cell sites in Ghana. The reason for choosing these companies was that they are the main architects in telecommunication tower construction projects and thus the best entities to be engaged when seeking information on the difficulties and challenges faced in the timely delivery of telecommunication tower construction projects in Ghana. These companies deliver a wide range of solution ranging from Greenfields to Rooftops as well as lattices, monopoles and disguised tower trees to mention a few. These solutions are implemented across the country at different heights; however, the study treated the delivery of all the different solutions as towers in general without segregating them into categories. Respondents were therefore selected from each of these three companies to seek their views on the important causes of delays in telecommunication tower construction in Ghana as well as the important remedies that can be adopted to address delays in the construction of the telecommunication towers.

1.8 Research Method

The quantitative research approach was used for the study. A quantitative approach stresses the objective measurement and the statistical and numerical examination of information gathered through polls, questionnaires and surveys, or the manipulation of existing statistical data using computational techniques (Babbie, 2010). Babie (2010) also noted that the quantitative approach stresses on assembling numerical information and generalizing it across groups of people or to describe a specific problem. An extensive review of literature was undertaken to

identify a list of delay causes in the telecommunication tower construction industry as well as delays in construction projects in general.

A survey strategy was used to gather data on the causes of delays in the construction of telecommunication towers as well as remedies that can be adopted to address the delays. The adopted strategy was a multiple case study one, where a survey was carried out on the three authorized tower companies in Ghana.

The target population of the study was therefore the telecommunication tower companies in Ghana whose head offices are in Accra. The research drew respondents from these three tower companies. A sample size of Forty (40) respondents were drawn from Sites Acquisition and Permitting Professionals and Consultants, Contractors, Project Managers and Engineers within the telecommunication tower construction companies. Questionnaires were then developed based on the list generated on the causes of delays and remedies to the causes of delays using the Likert scale to determine and rank each of the causes and remedies identified. The questionnaires were self-administered, and the data gathered was analysed using the Relative Importance Index (RII). The formula used to calculate the RII value of each variable factor was;

Relative Importance Index (RII) = $\sum W/AN$ (Famiyeh et al., 2017),

Where W, represents the weight assigned to each factor by respondents and ranges from 1 to 5, where 1 is the least important and 5 is extremely important. A - represents the highest weight (which is 5 in this study) and N represents the entire number of respondents.

1.9 Study Limitation

The study was restricted to only the authorised telecommunication tower companies in Ghana who have their offices in Accra. Although there may be other tower construction companies and mobile network operators whose views may have contributed immensely to the study, the study relied only on the tower companies who are authorised by the National Communications Authority to build and own telecommunications towers in Ghana. The generalization of this study should therefore take into consideration of these limitations.

1.10 Organization of the Study

This study was organized in five chapters. The foregoing chapter introduces the study, problem statement, the study aims, and objectives, significance of the study, scope and limitation of the study, the outline of the research methodology and organization of the study. Chapter two was devoted to review of relevant literature on the study area. Chapter three highlights the research and methodology. Chapter four provides an analysis of data, evaluation of the results of the study, while chapter five concludes the study. A summary of findings, conclusions, and recommendation are presented in the final chapter, Chapter Five. Bibliography and appendices are presented after chapter five. The Appendix section contains succinct documents referenced, the instrument used and other documents not readily available. Referenced documents and bibliography are presented in the recommended style and format.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This part of the study seeks to provide a complete review of existing literature in the subject area. The study was focused primarily on reviewing literature on the causes of delays in the construction of telecommunication towers and constructions delays in general and remedies to the causes of delay. The aim of the literature review was to have an insight into previous or similar studies relating to the subject to form the basis for identifying and discussing the causes and remedies of delays in the subject of the study.

2.2 Construction Delay

Agyekum-Mensah and Knight (2017) defined delay as the inability to meet the scheduled time. According to Surendran and Shankar (2017) construction delays can be defined as the slow achievement of work compared to the planned schedule or contract schedule. Enshassi et al. (2010) also defined time overrun as the extension of time beyond planned completion dates traceable to the contractors.

Sivaprakasam et al. (2011) defined construction delays as the time overrun beyond the specified completion date agreed in the contract. Hamzah et al. (2011) defined delay as time overrun or extension of time to complete the project. According to Rachid et al. (2018) delay is the product of an incident that has to be controlled by a suitable process in order to curtail its impact. Rachid et al. (2018) went further to indicate that systematic delay is detrimental to either the owner or the contractor. With the owner, delay results in forfeiture of potential revenue from the end product of the deliverables from the project and an increased in cost in managing and supervising the project. Whilst for the contractor, delay also results to an increase in cost as a result of extended schedule time or prolong work periods, high material, labour and overhead costs.

Construction delay can therefore be defined as any activity that leads to either extending or prolonging the delivery period of a project. Meaning any factor that distorts or extends the planned schedule of an activity.

2.3 Types of Construction Delays

Construction delays have been classified by a number of researchers (Enshassi et al., 2010; Hamzah et al., 2011; Sivaprakasam et al., 2011; Agyekum-Mensah and Knight, 2017). They

indicated delay types as Critical or Non Critical delays, Excusable or Non-excusable delays, Compensable or non-compensable delays, and Concurrent delays.

2.3.1 Excusable Delays

Excusable delays are caused by unforseen situations genuinely outside the remit of the contractor or the owner (Lepage, 2017). Examples are Labour unrest, fires, floods, earthquakes and any other natural disasters, changes introduced by the owner, errors and oversights in the plans, design documents and specifications, differing site conditions or concealed conditions. Often the construction contract will outline valid excusable delay causes (Lepage, 2017). Excusable delays are therefore the delays that falls outside the control of the owner or contractor and thus cannot be held accountable.

2.3.2 Non-excusable delays

Non-excusable delays are delays that fall within the control of the Owner or Contractor (Lepage, 2017). The Owner or the Contractor is entirely accountable for any activity that delays the project. Examples of non-excusable delays are late mobilization, late submission of proposals, delayed subcontractors work, delayed suppliers performance etc. Non xcusable delay may be compensable or non-compensable and can also result in an extension of time.

2.3.3 Compensable delays or Non-compensable delays

Lepage (2017) indicated that compensable delay is a delay where a party to the agreement is due for compensation as a result of delay to the project. He went further to indicate that the owner or contractor may be held accountable for either an extension of time or compensation for incurred cost or both. Cost compensation takes care of extra cost incurred as a result of delays or damages. Sivaprakasam et al. (2011) indicated that, with non-compensable delays contractors are unable to claim for compensation from excusable delays.

2.3.4 Critical delays or Non-critical delays

A Critical delay is a delay that has a bearing on the project‘s delivery time. According to Lepage (2017) a delay that does not influence or impact activities on a project‘s critical path does not warrant much attention except where there is some considerable amount of money involved. Sivaprakasam et al. (2011) stated that delays that affect the completion of a project

are called critical delays and delays that does not affect the duration or completion of the project are non-critical delays.

2.3.5 Concurrent Delays

According to Sivaprakasam et al. (2011) concurrent delay is the concept of presenting an analysis for common construction delays. He further went on to explain that the argument of concurrency is not to determine the critical delays point of view but from an attitude responsible for damages connected with the delay to the critical path. Enshassi et al. (2010) also clarified that concurrent delays arise where there are two or more independent delays during the same time period.

2.4 Types of Telecommunication Towers

KMB Design Group (2015) indicated six different kinds of towers commonly used for telecommunications; Lattice mast or towers, Guyed mast or towers, Monopole towers, Camouflage towers, Self-Support towers and Mobile Cell Towers (Tower-on-wheels or Cellon-wheels (COW)).

2.4.1 Lattice Towers

Lattice towers are freestanding and segmentally designed with rectangular or triangular base steel lattices (KMB Design Group, 2015). This type of tower construction can be useful in situations which require modifications such as mounting many panel or dish antennas. They can be used as electricity transmission towers, radio towers or as an observation tower.

2.4.2 Guyed Towers

According to the KMB Design Group (2015) guyed towers may be lightweight or heavyweight towers which are mainly seen as slim steel erections commonly seen in the tower industry. Guyed towers are intended to offer supreme strength, effectiveness, and flexibility with easy installation. They are reinforced by one or more levels of stranded steel guyed cables that are anchored to the ground.

2.4.3 Monopole Towers

Monopole towers are used in areas where space is a constraint, zoning is problematic or severe weather circumstances must be taken into consideration (KMB Design Group, 2015). They are built as a single pole and can either be a tubular section or a tapered pole and are also the less intrusive – making them the most prevalent tower types in the wireless communication industry because of the single-pole design. It advantageously decreases visual impact and has a shorter construction period as compared to the traditional lattice towers.

2.4.4 Camouflage Towers

Camouflage towers are typically used in urban areas when the need to reduce visual effect on the environment is a concern. They are often seen in the form of artificial pine trees, palm trees, clock towers and even in the form of artificial cacti (KMB Design Group, 2015).

2.4.5 Self-Support Towers

Self-support towers offer the most possibilities compared to other types of telecommunication towers and are considered appropriate for nearly all wireless communication applications. They come in either a three-legged triangular lattice towers or a four-legged square lattice towers (KMB Design Group, 2015). The supports of the selfsupport towers can accommodate substantial weights and the strongest of winds.

2.4.6 Mobile Cell Towers

Mobile cell towers (tower-on-wheels, cell-on-wheels) are said to be low-profile and transportable because they are often mounted on wheels (KMB Design Group, 2015). They come in a portable, small footprint and are inconspicuous and versatile in nature. They are normally deployed under temporary or emergency conditions; however, they are also useful where budget or regulatory permits are of a worry.

2.5 Causes of Construction Delays

Delays in construction projects are a major problem affecting the construction industry of which the telecommunication infrastructure industry is not an exception. Construction projects are considered to be successful when they are completed on time, within budget and all the stakeholders are satisfied with its quality (Hsu et tal., 2017). Studies have shown that construction projects are faced with delays in their completion. When there are delays in

construction projects, they are either expedited or the scheduled time for the completion of the project is extended (Rahsid et tal., 2013).

A number of researchers, Danso and Antwi (2012); Enshassi et al. (2010); Pethkar and Birajdar (2011); Chen *et al.* (2017); Fugar and Agyakwah-Baah (2010) have all identified factors causing delays in construction projects and have categorized them into groups namely: delays caused by clients, delays relating to the contractor, delays caused by consultants, materials related delays, delay as a result of labour, contract related delays and delays related to contractual relationship.

Sivaprakasam et al. (2011) in their research to review the causes of delays in construction projects, identified some delay causing factors to include; inexperience in the work, poor supervision, changes in design during construction by the owner, delay in delivery, coordination, project management problem, weather conditions, soil condition and slow mobilization.

A survey conducted by Shah (2016) to explore the causes for delay and cost overrun in construction projects in Australia, Malaysia and Ghana, identified ten important factors instigating delays in Malaysia‘s construction industry as listed below.

- Inappropriate planning by contractors
- Poor contractor‘s site management
- Contractor‘s inadequate experience
- Insufficient client‘s finance and payments for completed work
- Subcontractor‘s Problems
- Material shortages
- Equipment availability and failure
- Nonexistence of communication between parties
- Mistakes during the construction stage

Shah (2016), however, identified three critical factors each causing delay in Ghana, Malaysia, and Australia. Delay in payment certificates, underestimating of the project cost, underestimating the complexity of projects was identified to be associated with causes of delay in Ghana. In Australia, planning and scheduling deficiencies, methods of construction and

effective ways of monitoring & feedback were identified as critical factors, whereas in Malaysia, Contractor's improper planning, Contractor's poor site management and Inadequate contractor experience were identified. Durdyev et al. (2017) conducted a study on the causes of delay in residential construction projects using the relative importance index and revealed some important causes of delays by contractors and consultants to include: shortage of materials on site, unrealistic project scheduling, late delivery of material, lack of competent labour, difficulty of projects, work force absenteeism, rain effect on construction activities, design changes, delay by subcontractor and accidents due to poor site safety. Marzouk and El-Rasas (2014) in analysing delay causes in Egyptian construction projects, categorized the most important causes of delay into owner related, contractor related and consultant related causes. The important causes identified under the various categories in their research were: ineffective planning and scheduling of project, difficulties in financing project by contractor, finance and payments of completed work by owner, variation orders/changes of scope by owner during construction, late in revising and approving design documents by owner, poor site management and supervision, effects of subsurface conditions such as soil, high water table, etc., inexperience labour force, scarcity of construction materials on the market, subcontractors work delays, delays in amending and approving design documents by owners, interference of owners, holdup of work, errors and inconsistencies in design documents, lack of construction materials in the market and slow in making decisions.

Owalabi et al. (2014) in their study to investigate ―Causes and effects of delay on project construction delivery time‖, identified some major factors as delay causes which included: the lack of financial resources to fund the project to its completion, changes in design drawings, lack of effective communication among the parties, inadequate information from consultants, slow decision making and contractor‘s bankruptcy and variations. They also identified difficulties related to project management, mistake and discrepancies with regards to contract documentation, equipment availability and failure, mistakes during construction, unfavourable weather conditions, instability in building materials prices and labour strikes as causes of delay on construction project delivery time.

Apolot and Tindiwensi (2013) conducted a research to investigate the causes of delays and cost overruns in construction projects in Uganda's public sector. The study came out with five

important causes of delays which were; changes in the scope of works, delays in payments to contractors, poor monitoring and control and high inflation and interest rates.

2.6 Delays in Telecommunication Tower Construction Projects and Construction Delays in General in Ghana.

Construction delay is a global problem and its causes may differ from one country to the other. Delays in the construction of telecommunication towers in Ghana is a major problem, according to Danso and Antwi (2012), the telecommunication industry is an important contributor to every national economy and the construction of telecommunication cell sites provides infrastructure as well as employment opportunities to the citizenry and thus reduce unemployment in the country. The telecommunication industry relies on the deployment of new and upgrade of existing infrastructure to expand its network base. Owing to the dynamic and rapid evolution of technologies, the speed of deployment and upgrade of these infrastructure base make delays in construction and deployment very important. The construction of telecommunication towers in Ghana is bedevilled with many issues such as delays in construction, neighbourhood opposition to site construction and regulatory approval delays among others. Whereas many researches have been conducted worldwide on causes of construction delays/causes of delays in construction projects, (Danso and Antwi (2012) in Ghana; Durdyev et al. (2017) in Cambodia; Chen et al. (2017) in China; Famiyeh et al. (2017) in Ghana; Al-Kharashi and Skitmore (2009); Rachid et al. (2018), currently there appears to be little studies highlighting the causes of delays in the construction of telecommunication towers in Ghana.

The Mobile Network Operators in Ghana have associated their poor quality of service delivery to customers to how readily they get access to telecommunications infrastructure.

According to the NCA when some of the Mobile Network Operators (MNO‘s) where asked to give reasons for their poor quality of service, Glo - indicated the need for new sites especially in developing areas to improve coverage was a challenge, MTN indicated Site Acquisition, Fibre Cuts and Permitting issues as the three main challenges faced. MTN also indicated that in some few instances community resistance or neighbourhood agitations regarding to the new sites under constructions is a reason (National Communication

Authority (NCA Ghana), 2018a). All these reasons provided above by the MNO‘s who are clients to the tower infrastructure companies indicates that the slightest delay in constructing a tower indirectly affects their operations.

Danso and Antwi (2012) conducted a research ―evaluation of the factors influencing time and cost overruns in telecommunication tower construction in Ghana". Their study identified fifteen main influences to schedule delays in telecommunication tower construction in Ghana, namely: payment certificates issues, unrealistic client‘s requirements, unavailability of tower construction materials in the market, delays in design work and design data and agreement changes, poor workmanship resulting to rework, poor site supervision, unscrupulous behaviors of contractors to gain more returns, unbending behaviours among parties and Lack of experience among tower construction workmen. Danso and Antwi (2012) also, identified changes in the scope of design, inadequate quality assurance or control, lack of skilled managers for all parties and inappropriate contract management by the experts as the other causes, and went further to state that the slow granting of permits by the regulators to be another factor contributing to delays in the constructions of telecommunication towers in Ghana. Danso and Antwi (2012) sampled their respondents from the telecom network operators, however this study sampled its respondents from the tower construction companies who are specialized in the construction and management of tower sites.

Addo (2015) identified ten most critical factors that contribute to the causes of delays in a study to explore the factors affecting the delivery of projects in Ghana as; scarcity of construction materials; inappropriate site management and supervision; high rate of interest; improper project planning and scheduling; importation of construction materials; unskilled project team; inaccurate time estimates; contractor's financial difficulties and appreciation of material prices.

Famiyeh *et al.* (2017) identified factors causing construction time overrun in Ghana to be as follows; financial difficulties, impracticable contract periods imposed by clients, improper definition of project scope, variations originating from clients, under valuation of project cost by consultants, poor inspection/direction of projects. Other causes were not taking project complication serious by contractors, improper site management, unsuitable approaches to construction by contractors and permits approval delays by government regulators.

Fugar and Agyakwah-Baah (2010) also in Ghana concluded that the ten most important factors causing delay in building construction projects are: delay in honouring paymnet certificates,

underestimation of project cost, underestimation of project complexities, difficulty in accessing credit facilities, poor supervision, underestimation of project completion schedules by contractors, shortage of materials, poor professional management, fluctuation of prices/rising cost of materials and poor site management.

Amoatey et al. (2015) conducted a survey to analyze delay factors and its consequences in Ghanaian government housing construction projects. The study showed that the important factors that lead to project delays are the delays in making payment to contractors and suppliers, inflation/price instability, upsurge in material prices, insufficient funds from promoters or sponsors, discrepancy orders and deprived financial or investment market.

2.7 Summary of Causes of Construction Delay

Table 2.1: Important causes of delays in the construction of telecommunication towers

No	Important causes of delays in construction	Reference
1.	Delays in honouring Payment certificates	Danso and Antwi (2012), Fugar and Agyakwah-Baah (2010), Shah (2016)
2.	Improbable client‘s requirements	Danso and Antwi (2012)
3.	Unavailability of tower materials on the markets/Construction materials	Addo (2015), Marzouk and ElRasas (2014)
4.	Delays in design work, design information and contract modifications	Danso and Antwi (2012)
5.	Poor workmanship leading to rework	Danso and Antwi (2012)
6.	Improper site management	Shah (2016)
7.	Bad contractors behaviors to achieve high profits	Danso and Antwi (2012)
8.	Main disagreements or negotiations on site	Danso and Antwi (2012)
9.	Inexperience tower construction engineers/technicians or unqualified labour force	Sivaprakasam et. tal. (2011), Marzouk and El-Rasas (2014)
10.	Design scope changes	Durdyev et.tal. (2017)
11.	Unavailability of quality assurance or control	Danso and Antwi (2012)
12.	Insufficient decision-making skills for all parties	Danso and Antwi (2012)
13.	Consultants lack of contract management skills	Danso and Antwi (2012)
14.	Slow granting of permits by the regulators	Famiyeh *et al.* (2017)
15.	Improper project planning and scheduling	Marzouk and El-Rasas (2014),
16.	Incompetent project team;	Addo (2015)
17.	Contractor's financial difficulties and escalation of material prices	Addo (2015); Amoatey et al. (2015)
18.	Unrealistic contract durations imposed by clients	Famiyeh *et al.* (2017)
19.	Poorly defined project scope	Famiyeh *et al.* (2017)

20.	Under-estimation of the project cost	Fugar and Agyakwah-Baah (2010),
21.	Poor inspection/supervision of projects	Sivaprakasam et al. (2011)
22.	Underestimation of project complexity	Shah (2016)
23.	Fluctuation of prices/rising cost of materials	Owalabi *et al.* (2014)
24.	Variation orders	Amoatey et al. (2015),
25.	Neighbourhood agitation	NCA Ghana (2018b)
26.	Changes in the scope of works	Apolot and Tindiwensi (2013)
27.	Poor monitoring and control	Apolot and Tindiwensi (2013)
28.	Bad weather	Owalabi *et al.* (2014)
29.	Delays in revising and approving design documents	Marzouk and El-Rasas (2014)
30.	Effects of subsurface conditions such as soil, high water table, etc.	Marzouk and El-Rasas (2014), Si
31.	Mistakes and discrepancies in design documents	Marzouk and El-Rasas (2014)
32.	Shortage of materials on site	Durdyev et.tal. (2017)
33.	Late delivery of material	Durdyev et.tal. (2017)
34.	Inadequate client's finance and payment for completed works	Shah, (2016), Amoatey et al. (2015)
35.	Lack of Communication between parties	Shah (2016), Owalabi et al. (2014)
36.	Mistakes during the construction stage	Shah (2016)
37.	Improper contractor planning	Shah (2016)
38.	Project Management Problem	Sivaprakasam et al. (2011)
39.	Delays in sub-contractors work	Marzouk and El-Rasas (2014), Shah (2016)
40.	Changes in design during construction by the owner	Sivaprakasam et al. (2011)

Source: Compiled from Literature Review by Author

2.8 Remedies to Delays in the Construction of Telecommunication Towers

Danso and Antwi (2012) indicated that owners of telecommunication construction works must frequently review tender documents such as procedural provisions, illustrations, bill of quantities and the design of the project to prevent inconsistencies in tender documents which may result in disagreements between contracting parties. Danso and Antwi (2012) also recommended making prompt payments to contractors to avoid time overruns. They further indicated that contractors must ensure that there is proper construction planning and monitoring the value of works endlessly, establishing warehouses for the necessary construction supplies. They again suggested that consultants must monitor the quality of work and the various activities continuously to prevent mistakes that may result to rework. They also indicated that consultants should accelerate plans on appraisal and endorsement of design documents and to effect variation orders promptly.

Famiyeh *et al.* (2017) proposed the below remedies as strategies to adressing project schedule overruns in Ghana.

I. Remedies by clients

They indicated that it is prudent to ensure that clients have adequate resources prior to award of contracts, Prevent changes in design periods of the construction stage, prevent delays in the award of contracts and decision making and also staying within the agreed and accepted communication plans by all key stakeholders. They went further to indicate that if the above measures are adhered to, problems of project schedule overruns resulting from the client would be avoided.

II. **Remedies by consultants**

They indicated that problems of improper estimation of project schedule and cost must be circumvented by designing a thorough Work Breakdown Structure (WBS). Secondly, they advised consultants to initiate quick payments, engage skilled staffs for efficient inspections, directions and management of contracts. They also stated the importance of consultants in the issuance of major directions and also defining the project scope very clearly, avoiding of design variations and staying within the agreed communications plans. III. **Remedies by contractors**

They indicated the importance of contractors not to identify different ways of sourcing capital, effective site management, ensuring the use of correct construction approaches to prevent rework, sending the exact number of employees to the work site and providing the required apparatus, equipment and tools for them to work with. They further went on to advise that contractors hire competent and skilled staff to supervise matters relating to evaluations, institute proper and efficient financial management at the site and have the capability of executing the project on time.

Addo (2015) recommended the below remedies as means to curbing delys in construction projects.

1. Enhance contractor‘s managerial competence and technical know-how it is essential to regularly organize seminars, workshops and training programmes for the contractors in the construction industry to update their knowledge and their familiarity with project management techniques and procedures.
2. Contractors to engage experienced project managers and competent engineers with the required expertise in project management and professional practices to manage their

projects effectively and efficiently to bring down cost and time overruns that may emanate from delays in project implementation.

3. The long bureaucratic channels and processes that contractors go through before their payment certificates are honoured be reduced to guarantee continuous cash flow for projects to be accomplished on time.
4. Finally, clients should ensure that there are enough funds for a project before its commencement to guarantee that, payments for executed works are made on regular basis to enhance the continuous flow of work.

Amoatey *et al.* (2015) recommended that clients must ensure that funds for projects are fully secured and payment to contractors made on time as a means of remedy to resolve the delay in payment to contractors or suppliers. It is also worth noting that in the short run, adequate allocation of contingency funds should be made available for the project as a means of mitigating the problem of inflation and price fluctuations (Amoatey *et al.*, 2015). They went further to indicate that increase material prices are as a result of exchange rate increases from imports hence parties should explore sourcing construction materials from local sources. Amoatey *et al.* (2015) also indicated that variation orders which relates to scope changes by the owners during project execution can be minimized through early involvement of the client during the project design and planning phases, in order to help clarify project objectives and requirements.

Fugar and Agyakwah-Baah (2010) in their research to investigate the causes of delay of building construction projects in Ghana made the below recommendation as remedies to the delay causes;

Clients must ensure the availability of funds or arrangements are made for adequate supply of funds before the commencement of projects.

1. Lengthy and bureaucratic measures involved in making contractors payments to be reduced for efficiency. Contractor‘s payments must be paid as and when they become due in strict compliance with the provisions in the contract.
2. Contract provisions which allows contractors to claim interest on delayed payments must be strictly enforced to serve as a deterrent to clients.
3. The establishment of a commercial bank for the building and construction industry is worth revisiting to ensure that contractors have access to credits in periods of liquidity difficulties.

Again, Fugar and Agyakwah-Baah (2010) recommended that in order to solve some of the contractor‘s incompetence that relates directly with delay causes such as underestimation of project cost, time and complexities, inappropriate scheduling and control, and poor site management, the below must be adhered.

1. The Civil Engineering and Building Contractors Association of Ghana must come out with measures to ensure its members go through continuous education so that the technical and managerial proficiencies of contractors can be improved.
2. That the Ministry of Works, Water Resources and Housing who has the responsibility for the registration and classification of contractors wishing to execute public projects, must insist on its requirement that contractors must have in their employment certain key technical staff as a condition for registration. They also went further to state that effective ways must be designed to verify the list of staff produced by contractors in support of their application and to ensure that key employee positions are constantly filled with technically skilled persons.

Apolot and Tindiwensi (2013) in their study to investigate the causes of delays and cost overruns in construction projects in Uganda's public sector recommended that stakeholders in the construction industry are advised to minimize changes in their work scopes, as it has the greatest impact on cost and time overruns.

Sivaprakasam et al. (2011) recommended that to reduce the project delays the below can be taken into consideration to minimize the delays.

1. Develop effective planning and scheduling.
2. Appropriate site management and supervision.
3. Employing sate of the art technology.
4. Purchase of materials.
5. Effective coordination between all stakeholders involved in the project.
6. Employ acceptable construction procedures.
7. Estimation of the initial project sum.
8. Prompt decision making by owners.
9. Payments based on progress should be made promptly
10. Management of financial resources.

Marzouk and El-Rasas (2014) in analyzing delay causes in Egyptian construction projects recommended a few of the below suggestions in reducing construction delays. For owners, they suggested:

1. Setting realistic contract duration for the execution of the project.
2. Enough time to undertake feasibility studies for the project as well as developing a comprehensive financial and cash flow plans for the project.
3. Obtaining relevant approvals for the project and ensuring the readiness of funding essential for the project.
4. Making payment due to the contractor for the work being carried as well as the payments of finished items according to terms of the contract.
5. Engagement of qualified contractors in the field of work who has a good reputation.

For the consultants, the below were suggested:

1. Avoid delaying the response to contractor's enquiries as well as the approval of the submitted submittals and design drawings.
2. Creation of a control system to cater for, regulate, and appraise variation orders originating from the owner.

For the contractors, they suggested the below:

1. Establishment of a comprehensive financial and cash flow plan.
2. Development of a monitoring and periodical reports on critical and long lead items and occasionally providing a descriptive clarification of causes of any experienced delay.
3. Choosing a qualified subcontractor with a good reputation.
4. Establishing a good system for site management and supervision, and also developing effective planning and scheduling of activities for the project.

Durdyev et al. (2017) recommended the below as means of addressing project delays.

1. Ensure judicious supply of materials to the construction site.
2. Provide detailed and realistic work schedule for site supervisors to be able to follow and coordinate the activities.
3. Improvement of workforce resource through various education and training.
4. Creating an activity-based plan and schedule those activities which are suitable to be carried out outside during the rainy season period

5. The more complete job of defining scope, objectives and long-term plan. Concretely defined plans and goals will limit design changes.
6. Choose the subcontractor with better qualification and experience
7. Subcontractors have to be briefed about the scope of their work and properly managed by the contractor.

2.9 Summary of Remedies to address Delays in the Construction of Telecommunication Towers

Table 2.2: Important Remedies that can be adopted to address Delays

No	Remedies	Reference
1.	Revision of the bid documents such as technical specifications, drawings, bill of quantities and the design of the project to prevent discrepancy in bid documents which may lead to disputes among projects parties	Danso and Antwi (2012)
2.	Making of prompt payment to contractors to avoid time overruns	Danso and Antwi (2012)
3.	Contractors should ensure that there is adequate construction planning and monitoring the quality of activities continuously	Danso and Antwi (2012)
4.	Monitoring the quality of work and various activities continuously to avoid any mistakes that may lead to rework	Danso and Antwi (2012)
5.	Expedite action on review and approval of design documents, preparation of payment certificates for contractors and to effect change orders early enough	Danso and Antwi (2012)
6.	Avoid delays in the award of contracts and decision making	Famiyeh *et al.* (2017)
7.	Staying within the communication plans that have been agreed and accepted by all key stakeholders	Famiyeh *et al.* (2017)
8.	Underestimation of project time and cost should be avoided by developing a detailed WBS	Famiyeh *et al.* (2017)
9.	Initiate prompt payments	Famiyeh *et al.* (2017)
10.	Recruitment qualified personnel for effective inspections, supervisions and contract management	Famiyeh *et al.* (2017)
11.	Not to underestimate the complexity of any project no matter the scale	Famiyeh *et al.* (2017)
12.	Identifying alternative ways of raising funds	Famiyeh *et al.* (2017)
13.	Effective site management	Famiyeh *et al.* (2017),
14.	Regulatory bodies making the permitting process and requirements very clear to facilitate the timely acquisition of relevant permits	Famiyeh *et al.* (2017)
15.	Purchasing all materials in bulk or look for very good local substitutes of construction materials	Famiyeh *et al.* (2017), Sivaprakasam et al. (2011)

16.	Commencement of projects during dry weather conditions.	Famiyeh *et al.* (2017)
17.	Frequently organize seminars, workshops and training programs for the contractors	Addo (2015),
18.	Bureaucratic channels and processes that contractors go through before their certificates are honoured to be reduced	Addo (2015), Fugar and Agyakwah-Baah (2010)
19.	Adequate allocation of contingency funds to take care of inflation and price fluctuations	Amoatey et al. (2015)
20.	Early involvement of the client during the project design and planning phases to help clarify project objectives and requirements to avoid variation orders.	Amoatey et al. (2015), Famiyeh *et al.* (2017)
21.	Contract provisions which allows contractors to claim interest on delayed payments must be strictly enforced to serve as a deterrent to clients	Fugar and AgyakwahBaah (2010)
22.	Prepare effective planning and scheduling	Sivaprakasam et al. (2011)
23.	Obtaining the required approvals for the project from the relevant authorities	Marzouk and El-Rasas (2014)
24.	Avoid delaying the response to contractor‘s queries as well as the approval of the submitted submittals and design drawings	Marzouk and El-Rasas (2014)
25.	Choosing experienced subcontractors with a good reputation	Marzouk and El-Rasas (2014), Durdyev et al. (2017)
26.	Ensuring that there are enough funds before awarding contracts	Famiyeh *et al.* (2017), Addo (2015), Amoatey et al. (2015), Fugar and AgyakwahBaah (2010), Marzouk and El-Rasas (2014)
27.	Defining the scope of the project very clearly	Famiyeh *et al.* (2017), Apolot and Tindiwensi (2013), Durdyev et al. (2017)

Source: Compiled from Literature Review by Author

2.10 CONCLUSION

This section of the study discussed the various causes of delays in the construction of telecommunication towers in Ghana as well as causes of delays in construction projects in general. The discussion covered the views of various studies carried out globally including Africa and that of Ghana.

It also discussed remedies to address delays in the construction of telecommunication towers and construction projects in general.

It also discussed the various types of telecommunication towers used in telecommunication tower construction and the various tower companies authorized by the National Communications Authority to operate and own towers in Ghana.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter discusses the research method employed in arriving at the findings for this study. It seeks to establish sound reasoning in linking the steps employed to answer the research questions and achieve the objectives of the research. The research design, sample and sampling techniques, data collection instruments and finally an overview of the various studies will be presented in this chapter.

3.2 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in the procedure (Kothari, 2004).

The research framework used was a descriptive one hence a descriptive survey research study was preferred for this study. The design method that was used was the survey method where questionnaires were administered to seek the views of respondents in the study area. Closed ended questionnaires were administered.

The Likert scale type questionnaires were developed where respondents were asked to rank factors on a scale of 1 to 5. As noted by Jackson, (2009), researchers favour the use of the Likert-Scale type of questionnaire because it is easier to analyse statistically. Based on those characteristics, the descriptive design was considered as the most appropriate for conducting this study as it enabled the researcher to profile the sample or population by gathering accurate information on their views.

3.3 Research Strategy

A research strategy is referred to as a general orientation to the conduct of research (Brymman and Bell, 2007). The research strategy that was employed to undertake the study was that of quantitative research. It was a quantitative research since a multiple case study strategy was used where a survey was carried out on the three authorized tower companies in Ghana. The survey involved the designing and administering of Likert scale type questionnaires to source

information from respondents. The questionnaires were administered to respondents identified from the three main tower companies authorized to engage in the tower business in Ghana by the National Communication Authority (NCA). The respondents were sites acquisition and permitting professionals and consultants, contractors, project managers and engineers working within the selected telecommunication tower companies. Respondents were requested to indicate the relative importance of each causes of delays as well as remedies to address delays in telecommunication tower construction in the form of; One (1) which is Not Important to five (5) which is Extremely Important. The information gathered was then presented in the form of charts and tables and analysed statistically to determine the highest ranked causes of delays in the construction of telecommunication towers and remedies that can be adopted to address the delays.

Interviews were also carried out with prominent persons within the telecommunication industry to ascertain or justify whether delays really exist in the construction of telecommunication towers in Ghana.

3.4 Population of the Study

According to Zikmund (2003), the definition of the population was identifiable total set of elements of interest being investigated by a researcher. The target population of the study was the telecommunication tower construction companies in Ghana since they are the main entities involved in the telecommunication tower business hence the best source to seek information required for the study. According to the National Communication Authority (NCA 2018), there are currently three authorized Telecommunication Tower construction companies in Ghana; ATC Tower (GH) Limited, Eaton Towers Ghana and Helios Towers Ghana. The population for the study therefore included Project Managers, Engineers and Sites Acquisition and Permitting Professionals and Consultants. The research thus drew respondents from these three tower companies which constituted the case organizations.

3.5 Sample Size

The sample size refers to the number of elements selected from which information is collected for a study (Lavrakas, 2008). A sample size of Forty (40) respondents was drawn from sites acquisition and permitting professionals and consultants, contractors, project managers and engineers working within the telecommunication tower construction companies. Famiyeh *et*

al. (2017) who conducted a similar study ―Major causes of construction time and cost overruns‖ chose a sample size of thirty (30) for their study. Another research conducted by Fugar and Agyakwah-Baah (2010) ―Delays in Building

Construction Projects in Ghana‖ also used a sample size of fifty (50) respondents. Also, Danso and Antwi (2010) who conducted a similar research ―Evaluation of the factors influencing time and cost overruns in telecom tower construction in Ghana‖ employed a sample size of Sixty-Seven (67) for their study. The basis of choosing a sample size of forty (40) was based on the judgement of the researcher and references to previous studies in the subject area. The sample size was therefore representative enough for the three selected case organization. The choice of these respondents from the sample population therefore emanated from the view that they are the main architects involved in telecommunication tower construction hence the main source of information for the study. Sixteen (16) respondents were drawn from ATC Tower (GH) Limited, Fourteen (14) respondents from Eaton Towers and Ten (10) from Helios Towers.

The below tables show the distribution of respondents for each professional category from the various tower construction companies.

Table 3.1: ATC Tower (GH) Limited

Professional Background	Title	Number
Project Managers	Head of Projects	1
	Project managers	3
Engineering	Quality Assurance & Tower Infrastructure	3
Sites Acquisition and Permitting (Professionals)	Sites Acquisition and Permitting (BTS & BTF) Officials	3
Contractors	Project Managers	3
Sites Acquisition and Permitting Consultants	Senior Consultants	3

Source: Compiled by Author

Table 2.2: Eaton Towers Ghana

Professional Background	Title	Number
Project Managers	Head of Projects	1
	Project Managers	3
Engineering	Quality Assurance	2
Sites Acquisition and Permitting (Professionals)	Sites Acquisition and Permitting Officials	3
Contractors	Project Managers	3
Sites Acquisition and Permitting Consultants	Senior Consultants	2

Source: Compiled by Author

Table 3.3: Helios Towers Ghana

Professional Background	Title	Number
Project Managers	Head of Projects	1
	Project Managers	2
Engineering	Quality Assurance	2
Sites Acquisition and Permitting (Professionals)	Sites Acquisition and Permitting Officials	2
Contractors	Project Managers	2
Sites Acquisition and Permitting Consultants	Senior Consultant	1

Source: Compiled by Author

3.6 Sampling Technique

A non-probability sampling technique was employed in this study because the researcher had a target population in mind that meets the criteria of respondents for the study. Under this sampling technique, the purposive sampling was used. Purposive sampling technique was used to select the key respondents from the population to participate in the study because it enabled the researcher to reach a sample of the population who are abreast with the subject matter. In the study, the researcher used his own judgment about which respondents to choose and selected only those who best met the purpose of this study.

Although the population for the study could have been widen to cover the telecommunication industry in general, that would have included the regulators, the Mobile Network Operators and other key operators within the industry, the researcher decided to limit the study to the Tower Construction Companies because they are heavily involved in the tower delivery process and as such are the main source to sought information for the study.

In terms of respondents from the selected case organizations, the Project Managers, Engineers, Contractors, and Site Acquisition and Permitting Consultants and Officials were selected based on the peculiarity of each Tower Construction Company as well as their understanding and experience of what goes into telecommunication tower construction in the country.

3.7 Sources of Data

Data for the survey was sourced from both primary and secondary sources. Primary data was obtained through the administration of a structured questionnaire and interviews. The researcher therefore used questionnaire to gather information from respondents selected from the selected case organizations earmarked for the study. An advantage of using primary data sources is that they are more reliable since they come from the original source and was collected specifically for this study.

Secondary data was also sourced from available literature on similar related studies. The main sources of secondary data included published and unpublished materials like journals, textbooks, newspapers, etc. Secondary data collected assisted significantly in the development of primary data collection instruments and the interpretation of the results.

3.8 Data Collection Instrument

The instrument that was used by the researcher was that of a structured questionnaire. A structured questionnaire is a type that has multiple answers provided and the respondents would be expected to pick one or as many as are relevant or applicable. The questionnaires were developed from the data gathered from the secondary sources using the Likert scale type questionnaires where respondents were given the opportunity to rank the causes identified according to their level of importance. The Likert-Scale type questionnaires enabled the researcher to survey the views of the respondents on the importance of the factors identified. The secondary data was also obtained from various sources such as the internet, journals, reports from the National Communication Authority and brochures.

The questionnaire was used in this study because it is appropriate for the respondents and it facilitated the collection of large amounts of data in a relatively short period. It was also easier to quantify and treat statistically. The questionnaires also guaranteed confidentiality and anonymity of respondents since was generally self-reporting and elicited more honest responses compared to the other data collection techniques.

3.9 Data Collection Procedures

Data was collected over a period of seven (7) days. First, the researcher asked permission to collect data within a grace period of two weeks. On the organization of questionnaires, since the researcher had the target population in mind, respondents were selected based on his own judgement. I used my identification card from the university attached to the questionnaires that explained the reason for the questionnaires and the purpose of the study. The questionnaires were left with the respondents and collected back within a period of one week. These measures were taken to ensure privacy, encourage sincerity and to ensure that the respondents remain unknown.

3.10 Data Analysis

After collecting the data, it was checked and scrutinized for errors, missing values and consistency. The numerical information obtained was imputed into an excel sheet generated with the Relative Importance Index (RII) formula. The data was analysed to determine the ranking for the various factors. The ranking was however manually generated determine the most important causes and remedies

3.10.1 Method of Analysis

The Relative Importance Index (RII) was deployed in analysing the retrieved data from the study‘s respondents to rank both the causes of delay and the remedies to address the delays.

The RII was used because it is an accepted method that have been used to analyse data by previous researchers. Amoatey et al. (2015) who conducted a research to analyse delay causes and effects in the Ghanaian state housing construction projects used the Relative Importance Index to analyse their data. Famiyeh et al. (2017) who also conducted a survey
―Major causes of construction time and cost overruns‖ used the RII.

Another study conducted by Danso and Antwi (2012) ―Evaluation of the factors influencing time and cost overruns in telecom tower construction in Ghana‖ used the RII to analyse the collected data. Sambasivan and Soon (2007) in their study ―Causes and effects of delays in Malaysian construction industry‖ employed the RII as the technique in analysing their data. Sivaprakasam et al. (2011) also used the RII in their study ―A review on causes of delay in construction projects‖.

The RII's of the various factors was therefore ranked to determine the one that appears most among the factors. The formula adopted for ranking the factors was;

Relative Importance Index (RII) = $\frac{\sum W}{AN}$

Where, W is the weight given to each factor by the respondents and ranges from 1 to 5, where 1 is Not important and 5 is extremely important.

A= the highest weight (i.e. 5 in this study) N=

the total number of respondents.

3.11 Validity and Reliability

In all research, the methods and conclusion need to be justified. The justification has to demonstrate the nature of the decision making during the research, and on which ground the decisions are reasonable for the reader (Denscombe, 2003).

3.11.1 Reliability

The research was objective regarding the handling and evaluating the collected data. A structured questionnaire was used for the respondents to answer because of its reliability. Structured questionnaires allow for a wider number of the population to be accessed and ensures that each member of the selected sample answers exactly the same question hence making it a reliable approach to the study.

3.11.2 Validity

Validity is defined as whether methods, approaches, and techniques actually measure and relate to the problem that has been explored (Blaxter et tal., 2001). According to Yin (2003), there are three forms of validity; construct, internal and external validity. To test the validity of the study instrument, the questionnaires were pretested asking experts on telecommunication tower

construction to look at the questions and give comments on them to ensure that the questions related to the objectives of the study. Ambiguous questions were corrected, and others dropped. The adjusted questionnaire was then used for the study.

3.12 Ethical Consideration

The objective and role of respondents in the study were highlighted to them and how to fill the questionnaires after which instruments were distributed personally and collected after being administered to respondents. Participation in this study was voluntary, and all respondents were reminded of their right to withdraw at any time during the study.

CHAPTER FOUR
DATA COLLECTION AND DATA ANALYSIS

4.1 Introduction

This chapter examines the responses provided by the representatives of the telecommunication tower construction companies participating in the study. The responses are summarized into charts and tables where appropriate. The chapter is organized based on objectives set out at the commencement of the study. To answer the objectives of the study, questions were asked to justify if there are really delays in the construction of telecommunication towers in Ghana. A few prominent people within the fold of the
Telecommunication Tower Companies (Tower Co‘s) and the Mobile Network Operators (MNO‘s) in the telecommunication industry were interviewed to ascertain whether delays really exist.

The Mobile Network Operators did indicate that delays exist, and it really affects their rollout plans year in year out since their expansion and improvement in their network capacities are heavily dependent on how readily new tower infrastructures are made available by the Tower Companies (Tower Co's). The Tower Co‘s also affirmed the notion of delays in delivery of telecommunication tower construction projects in Ghana and that the phenomena affects their operations and needs to be addressed.

This chapter therefore analysed the responses of individuals who are involved in the construction of telecommunication cell sites within the country to ascertain the important causes as well as remedies that can be adopted to address them.

4.2 Overview of the Selected Case Organizations

According to the National Communication Authority there are three authorized tower companies in Ghana. These companies are authorized to build, own and manage towers in Ghana, and these companies are; ATC Tower Ghana Limited (ATC Ghana), Eaton Towers Ghana Limited and Helios Towers Ghana (HTG) Managed Services Limited (National Communication Authority (NCA Ghana), 2018b).

4.2.1 Helios Towers Ghana (HTG)

The principal business of Helios Towers involves the construction, buying and operating telecommunications towers that are suitable of accommodating and driving the needs of numerous tenants. These tenants are usually large MNO‘s and other telecommunication providers who in turn provide wireless voice and data services, primarily to end-consumers and businesses. Helios also offers a wide-range of tower-related operational services, including site selection, site preparation, maintenance, security and power management. They provide space on tower sites under a combination of master lease agreements (MLA‘s), which provide the commercial terms that govern the provision of tower space, and individual site agreements (ISA‘s), which act as an appendix to the relevant MLA and include sitespecific information. They also enter into ground lease agreements with property owners to host sites on their land. **Source: (Helios Towers Ghana, 2019)**

4.2.2 Eaton Towers Ghana

Eaton Towers is a leading independent Pan-African tower company with over 5000 tower sites in five African nations: Ghana, Uganda, Kenya, Burkina Faso, and Niger. They acquire, build and lease shared infrastructure services on tower sites to mobile operators. They pride themselves in highly experienced local teams, diverse site portfolio and ability to customize their offering to meet the exact needs of their customers. All of Eaton Towers in-country operations are ISO certified, highlighting their commitment towards Quality, Environmental and Occupational Health and Safety management. Eaton Towers was co-founded in 2009 by current CEO, Terry Rhodes. Alongside the majority shareholder, Capital International, investors include Development Partners International, Ethos and Standard Chartered. **Source: (Eaton Towers Ghana, 2019)**

4.2.3 ATC Tower (Ghana) Limited

ATC Tower (Ghana) Limited (―ATC Ghana‖) is a leading wireless and broadcasting communication infrastructure company. ATC Ghana is a subsidiary of American Tower Corporation, which currently has a portfolio of towers and managed rooftop space in various countries including Ghana. Their business is providing tower infrastructure for collocation or site sharing to their customers, and their key expectation for business is a market leading delivery. ATC provides several smart alternatives such as in-building system, stealth sites, camouflage sites, and rooftops. At ATC, integrity and accountability are important, they don‘t

conduct business without them, and it is part of their core principles. They value their assets, communities they operate in and their people.

Source: (ATC GHANA, 2019)

4.3 Location of the Organizations

All the tower construction companies used for the study have their offices in Accra, situated as follows; Helios Towers at Airport Residential Area, 31 Akosombo Road, ATC Ghana have their office location at the 5th Avenue Corporate Offices, Plot 32 Osu Avenue, West Cantonments and Eaton Towers office also located at No 12 Tafawa Belewa Street, North Ridge.

4.4 Professional Background of Respondents

Out of the 40 questionnaires that was administered, Project Managers were 11, Engineers 7, Site Acquisition and Permitting (Professionals) 8, Contractors 8, Site Acquisition and Permitting Consultants 6

Table 4.1: Professional Background of Respondents

Type of Work	No. of Respondents
Project Managers	11
Engineering	7
Site Acquisition and Permitting (Professionals)	8
Contractors	8
Site Acquisition and Permitting Consultants	6
TOTAL	**40**

SOURCE: Field Data (2019)

4.5 Evidence of Delays in Tower Construction Projects by the Telecommunication Tower Companies (Tower Co's) in Ghana

Information gathered from discussions and interviews with individuals within the three authorized tower companies in Ghana by the national Communication Authority (NCA) yielded the below information regarding actual deliveries of tower construction projects for the years 2016/17, 2017/18 and 2018/19. The three companies were ATC Tower Ghana Limited, Eaton Towers and Helios Towers Ghana.

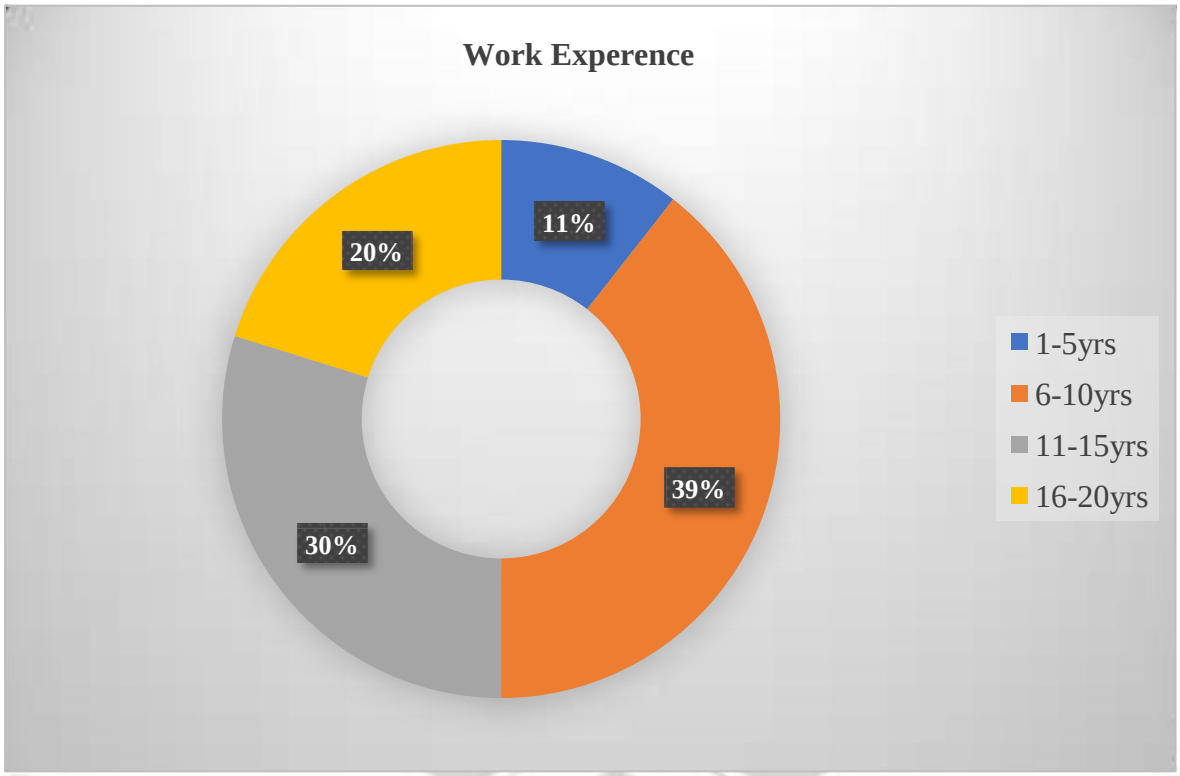
Table 4.2: Data on Actual Deliveries of the Tower Companies in Ghana from 2016-2019

Company Name	Year	Total No. of Sites Planned for the year	No. of Sites Delivered on Time	% of sites delivered on Time	No. of Sites Delayed	% of sites delayed
ATC Tower (GH) LTD	2016/17	60	50	83%	10	17%
	2017/18	122	85	69%	37	30%
	2018/19	85	60	70%	25	29%
Average	**16-19**	**89**	**65**	**74%**	**24**	**25%**
Helios Towers Ghana	2016/17	50	34	68%	16	32%
	2017/18	70	46	66%	24	34%
	2018/19	80	55	69%	25	31%
Average	**16-19**	**67**	**50**	**68%**	**22**	**32%**
Eaton Towers	2016/17	72	50	69%	22	31%
	2017/18	60	40	66%	20	34%
	2018/19	102	71	70%	22	30%
Average	**16-19**	**60**	**54**	**68%**	**21**	**31%**

Source: Information Sourced from the three Tower Companies in Ghana (Tower Co's)

From the information provided in the table above, ATC Tower (GH) LTD had an average of 25% delay in telecommunication tower construction projects for the period 2016 to 2019. Helios Towers Ghana had an average of 32% delays for the same period whereas Eaton Towers had an average delay of 31% for the same three-year period.

Figure 4.1: Working Experience of Respondents



SOURCE: Field Survey Data (2019), Extracted from Researcher's Self- Administered Questionnaire

Table 4.3: Relative Importance Index (RII) of Causes of Delay in the Construction of Telecommunication Towers

No.	Parameters	Response Ranking					Total	RII	Rank
		1	2	3	4	5	40		
1	Delays in honouring Payment certificates	1	0	9	13	17	40	0.825	3rd
2	Unrealistic client's requirements.	3	8	6	12	11	40	0.70	6th

3	Lack of tower materials in the local markets and Construction materials	3	7	4	5	21	40	0.77	4th
4	Delays in design work and design informationand contract modifications	18	0	20	2	0	40	0.43	24th
5	Poor workmanship leading to rework	1	24	5	5	5	40	0.545	21st
6	Poor site management	0	15	10	15	0	40	0.60	17th
7	Unethical behaviors of contractors to achieve high profits	0	10	10	20	0	40	0.650	12th
8	Major disputes or negotiations on site	10	10	0	10	10	40	0.60	17th
9	Inexperience tower construction engineers and technicians or unqualified workforce	5	7	14	11	3	40	0.60	17th

10	Design scope changes	4	4	26	2	4	40	0.59	18th

11	Lack of quality assurance or control	6	9	4	18	3	40	0.615	15th
12	Inadequate managerial skills for all parties	9	7	8	6	10	40	0.605	16th
13	Poor contract management by consultant	12	0	4	14	10	40	0.65	12th
14	Slow granting of permits by the regulators	2	2	0	16	20	40	0.85	2nd
15	Improper project planning and scheduling	8	6	9	5	12	40	0.635	13th
16	Incompetent project team	12	7	3	12	6	40	0.565	19th

17	Contractor's financial difficulties and escalation of material prices	3	7	4	5	21	40	0.77	4th
18	Unrealistic contract durations imposed by clients	0	1	6	13	20	40	0.86	1st
19	Poorly defined project scope	2	11	9	10	8	40	0.655	11th
20	Under-estimation of the project cost	6	8	7	11	8	40	0.635	13th
21	Poor inspection and supervision of projects	10	6	0	12	12	40	0.65	12th
22	Underestimation of project complexity	9	8	4	6	13	40	0.63	14th
23	Fluctuation of prices/ rising cost of materials	6	9	5	13	7	40	0.63	14th
24	Variation orders	4	7	12	8	9	40	0.655	11th

25	Neighbourhood agitation	2	2	0	16	20	40	0.85	2nd
26	Changes in the work scope	5	8	5	12	10	40	0.67	9th
27	Bad weather	15	10	4	7	4	40	0.475	23rd
28	Late in revising and approving design documents	4	8	5	12	11	40	0.690	8th
29	Effects of subsurface conditions such as soil, high water table, etc.	7	8	13	4	8	40	0.59	18th
30	Mistakes and discrepancies in design documents	9	11	7	10	3	40	0.535	22nd
31	Shortage of materials on site	7	8	13	4	8	40	0.59	18th
32	Late delivery of material	5	5	8	10	12	40	0.695	7th

33	Inadequate client's finance and payment for completed work	5	9	10	10	6	40	0.615	15th
34	Lack of communication between parties	7	6	12	7	8	40	0.615	15th
	Mistakes during the								
35	construction stage	6	8	7	11	8	40	0.635	13th
36	Improper contractor planning	4	8	13	7	8	40	0.635	13th
37	Changes in design during construction by the owner	7	4	9	9	11	40	0.665	10th
38	Project management problem	6	0	6	12	16	40	0.76	5th
39	Delays in subcontractors work	12	6	8	7	7	40	0.555	20th
40	Poor monitoring and control	1	0	9	13	17	40	0.825	3rd

SOURCE: Field Survey Data (2019), Extracted from Researcher's Self- Administered Questionnaire

4.6 Brief Discussions on the Important Causes of Delays in Telecommunication Tower Construction

Respondents for this study were asked to rank the important factors on the causes of delay in the construction of telecommunication towers in Ghana and how each importantly contributes to delay. Fourty (40) cause were observed to be important and to determine the important causes of delay, the Relative Importance Index was used. The Relative importance index of above 70 percent was chosen to be important.

In reference to Table 4.2, Unrealistic contract duration imposed by clients was ranked first (1^{st}) with a Relative Index of 0.86 as an extremely important factor of causes of delay in constructing the telecommunication towers by respondents. Neighbourhood agitation and slow granting of permits by the regulators was ranked as the second (2^{nd}) most important factor to the causes of delay in telecommunication tower construction with a Relative Index of 0.85. Most at times, without enough communication with the stakeholders within the neighbourhood, it leads to agitation by them to oppose the construction of the telecommunication towers. Slow granting of permits by the regulators also gain major attention by the respondents as a major deterrent in the construction of the telecommunication towers.

Respondents also ranked two parameters as the third (3^{rd}) most important factors, which were poor monitoring and control, and delays in honouring of payment certificates with a Relative Index of 0.825. Research which was done by Fugah and Agyarkwah-Baah (2010) indicated that this problem is one of the main contributing factors that cause delays in projects as a whole in Ghana. Payment delays may result in delay therefore adequate funding prior to the award of the contract is necessary to ensure that the project cost remains within budget.

Lack of tower materials in the local markets/construction materials and contractor's financial difficulties and escalation of material prices were the fourth-ranked most important factors causing delays in the construction of telecommunication towers with an index of 0.77, a study conducted by Mbachu and Nkado (2004) revealed that globally, the construction industry is plagued with cost in project delivery which makes it unattractive to savers. Most contractor‘s face financial difficulties due to lack of payment by clients during the construction of the telecommunication towers. Also due to unavailability of funds to buy the necessary materials on time, prices of the products also shoot up and it leads to the project being stalled.

The fifth (5th) contributing factor with a Relative Index of 0.76 was project management problem which is associated with the handling of a project from its inception to finishing. It is recommended that consultants monitor the quality of work in various activities continuously so as to avoid any mistake that may lead to rework.

Finally, further research works need to be carried out on enhancing quality and productivity improvement to minimize the delay on the tower construction projects. The application of six sigma method to improve quality and productivity of telecommunication tower construction, development of Total Quality Management model to mitigate effects of delay in telecommunication tower construction projects, and to examine the impact of health, safety and environmental management systems on telecommunication tower construction projects.

Contributing factors from sixth with Relative Index of 0.7 to the lowest Relative Index of 0.43 are all important causes of delay in the construction of telecommunication towers as shown in Table 4.2 above with its ranking that needs solutions to minimize or curb its effect on the successful construction of telecommunication towers.

Table 4.4: Relative Importance Index (RII) of Remedies to adress Delays in the Construction of Telecommunication Towers

No.	Parameters	Response Ranking					Total	RII	Rank
		1	2	3	4	5			

1	Revision of the bid documents such as technical specifications, drawings, bill of quantities and the design of the project to prevent discrepancies in bid documents which may lead to disputes between projects parties	5	5	10	10	10	40	0.675	6th
2	Making of prompt payments to contractors to avoid time overruns	10	4	6	10	10	40	0.63	9th
3	Contractors should ensure that there is adequate	2	9	6	8	15	40	0.725	3rd

	construction planning and monitoring the quality of activities continuously								
4	Monitoring the quality of work and the various activities continuously to avoid any mistakes that may lead to rework	8	8	12	7	5	40	0.565	18th
5	Expedite action on review and approval of design documents, preparation of payment certificates for contractors and to effect change orders early enough	6	8	12	8	6	40	0.60	14th

6	Ensuring that there are enough funds before awarding contracts	5	8	7	7	13	40	0.675	7th
7	Avoid delays in the award of contracts and decisionmaking	4	2	16	6	12	40	0.70	6th
8	Staying within the communication plans that have been agreed and accepted by all key stakeholders	8	3	9	12	8	40	0.645	9th
9	Underestimation of project time and cost should be avoided by developing a detailed WBS	7	12	10	2	9	40	0.57	17th
10	Initiate prompt payments	5	6	4	9	16	40	0.725	3rd
	Recruitment of qualified								
11	personnel for effective inspections, supervisions and contract management	9	6	8	7	10	40	0.615	12th
12	Defining the scope of the project very clearly	4	9	12	8	7	40	0.625	11th
13	Not to underestimate the complexity of any project no matter the scale	6	7	14	9	4	40	0.59	15th
14	Identifying alternative ways of raising funds	8	3	13	7	9	40	0.63	10th

15	Effective site management	4	16	7	5	8	40	0.585	16th
16	Regulatory bodies should make the permitting process and requirements very clear to facilitate the timely acquisition of relevant permits	3	2	11	11	13	40	0.745	2nd
17	Purchasing all materials in bulk or look for very good local substitutes of construction materials	4	7	6	8	15	40	0.715	4th
18	Commencement of projects during dry weather conditions	8	8	6	7	11	40	0.625	10th
19	Frequently organize seminars, workshops and training programs for the contractors	12	8	9	4	7	40	0.53	19th
	Bureaucratic channels and								
20	processes that contractors go through before their certificates are honoured to be reduced	0	5	8	10	17	40	0.795	1st
21	Adequate allocation of contingency funds to take care of inflation and price fluctuations	3	2	11	11	13	40	0.745	2nd

22	Early involvement of the client during the project design and planning phases to help clarify project objectives and requirements to avoid variation orders.	7	5	10	7	11	40	0.65	9th
23	Contract provisions which allows contractors to claim interest on delayed payments must be strictly enforced to serve as a deterrent to clients	9	5	9	8	9	40	0.615	12th
24	Prepare effective planning and scheduling	4	7	10	11	8	40	0.66	8th
25	Obtaining the required approvals for the project from the relevant authorities	12	8	1	9	10	40	0.585	16th
26	Avoid delaying the response to contractor's queries as well as the approval of the submitted submittals and	3	9	16	8	4	40	0.605	13th
	design drawings								
27	Choosing experienced subcontractors with a good reputation	8	2	4	12	14	40	0.710	5th

SOURCE: Field Survey Data (2019), Extracted from Researcher's Self-Administered Questionnaire

4.7 Brief Discussions on the Remedies to address Delays in the Construction of Telecommunication Towers in Ghana

Remedies that can be adopted to address delays in the construction of telecommunication tower projects are very imperative to ensure the success of projects as a whole in Ghana. Respondents

for this study were asked to rank the important factors that can be adopted to address delays in the construction of telecommunication towers and how each contribute to reducing the causes of delay.

Twenty seven (27) factors were observed to be important remedies that can be adopted to address delays in the construction of telecommunication towers, to determine their importance the Relative Importance Index was used. The Relative index of above seventy percent (70%) was chosen to be Extremely important.

Bureaucratic channels and processes that contractors go through before their certificates are honoured to be reduced was ranked first (1st) with an index of 0.795 on the remedies that can be adopted to address delays in the construction of telecommunication towers. Contractors go through so many bureaucracies before their certificates are honoured and payments are made. Respondents had the view that a number of project management tools such as cash flow forecasting, robust cost management plan, and risk management plan can be used to manage this effect.

The second (2nd) important remedy identified was the adequate allocation of contingency funds to take care of inflation and price fluctuation with a Relative Index of 0.745. Most of the respondents suggested from the table that there must be an adequate funds allocation for contingency so that it can take care of inflation and price hikes of materials used in the construction of telecommunication towers. Regulatory bodies should make the permitting process and requirements very clear to facilitate the timely acquisition of relevant permits was also ranked second (2nd) with an index of 0.745. Respondents were of the view that if the permitting requirements and processes were made clear it would go a long way in reducing the cumbersome nature of acquiring development permits for execution of projects in the country.

The respondents also chose two parameters as the third (3rd) remedy that can be adopted to address the causes of delays in the construction of telecommunication towers with a Relative Index of 0.725 for each. These were Initiation of prompt payments and contractors should ensure that there is adequate construction planning and monitoring the quality of activities continuously. To eradicate this problem, contractors should address the challenge of improper payments and there must be enough funding before commencement of the construction of the

tower and good payment schedule to ensure that proper payments are made. On the other parameter, which is contractors should ensure that there is adequate construction planning, monitoring the quality of activities; every project requires adequate planning for its successful execution and some of the respondents were of the view that tools such as Work Breakdown Structure (WBS) allows easy planning and scheduling of a project and its activities (Lanford and McCann, 1983).

The fourth (4^{th}) most important in the remedies that can be adopted to address delays in the construction of telecommunication towers with a Relative Index of 0.715 was Purchasing all materials in bulk or look for very good local substitutes of construction materials. Respondents were of the view that since most of the materials used in the construction of the telecommunication towers are imported, it is prudent to purchase these materials in bulk or seek alternative local materials to ease the problem of materials shortage or the unavailability of materials on the local market.

The fifth (5^{th}) most important factor in the remedies that can be adopted to address delays in the construction of telecommunication towers with an RII of 0.710 was choosing experienced subcontractors with a good reputation to undertake the construction of the telecommunication towers. It is believed that an experienced contarctor is bound to deliver a project on schedule and within cost as compared to an inexperienced contractor. It is therefore prudent to award contracts to experienced contractors in order to reduce delays in delivering projects.

In concluding on the results of this study, it is well noted that bureaucratic channels and process that contractors go through before their certificates are honoured, adequate allocation of contingency funds to take care of inflation/price fluctuation, initiation prompt payments and contractors should ensure that there is adequate construction planning, monitoring the quality of services, regulatory bodies should make the permitting process and requirements very clear to facilitate timely acquisition of relevant permits, Purchasing all materials in bulk or look for very good local substitutes of construction materials and choosing experienced subcontractors with good reputation to undertake the construction of the telecommunication towers were some of the important remedies that can be adopted to address elays in construction of the telecommunication towers in this study.

Finally, there is the need for a consultative and collaborative interface between the clients, consultants, engineers, site acquisition and permitting professionals and consultants at all stages of the construction of the telecommunication tower is essential to ensure its success.

CHAPTER FIVE
SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter of the study forms the concluding part of this academic study. In this chapter, a summary of all discussions held in the analytical section of the study is presented with conclusions drawn accordingly. Again, as required in any academic research, policy recommendation is forwarded in this chapter. The aim of the study was to evaluate the causes of delays in the construction of telecommunication towers in Ghana and the main objectives were to identify the important causes of delays in the construction of telecommunication towers in Ghana and also to identify the important remedies that can be adopted to address delays in the construction of telecommunication towers.

5.2 Summary

This study set out to evaluate the causes of delays in the construction of telecommunication towers in Ghana. The specific objectives were to identify the important causes of delays in the construction of telecommunication towers and to identify the important remedies that can be adopted to address delays in the construction of telecommunication towers in Ghana. The outcome of this study was expected to serve telecommunication tower companies, contractors and clients with the requisite knowledge on the possible causes of delays in the construction of telecommunication towers accordingly.

A brief search on existing literature on the subject matter indicated that popular among the various types of causes of delay identified by previous writers are physical works, disputes, supervision, and directions.

From the analyses, it was established that the important causes of delays in the construction of telecommunication towers were;

i. Unrealistic contract duration imposed by clients ii. Neighbourhood agitation iii. Slow granting of permits by the regulators iv. Poor monitoring and controlling
v. Delays in honouring of payment certificates vi. Lack of tower materials in the local markets/Construction materials vii. Contractor‘s financial difficulties and escalation of material prices viii. Project management problem.

The study again showed the important remedies that can be adopted to address delays in the construction of telecommunication towers to include;

i. Reducing the bureaucratic channels and processes that contractors go through before their certificates are honoured.
ii. Adequate allocation of contingency funds to take care of inflation and price fluctuation.
iii. Regulatory bodies to make the permitting process and requirements very clear to facilitate timely acquisition of relevant permits.
iv. Initiation of prompt payments

v. Contractors to ensure that there is adequate construction planning and monitoring the quality of activities continuously.

vi. Purchasing of the materials in bulk or look for very good local substitutes of construction materials.

vii. Choosing experienced subcontractors with good reputation to undertake the construction of the telecommunication towers.

5.3 Conclusion

In drawing a conclusion on the various submission on causes of delays in the construction of telecommunication towers in this study, it is worth establishing that, task such as preventing disputes on the site, poor workmanship, poor site management all need to be considered by the contractors, consultants and clients need to work in consultation to form a vital team to be able to deliver a successful project. The above is a major task and paramount which needs attention by project managers in the telecommunication industry.

Findings from this research also indicated that, the important causes of delays in the construction of telecommunication towers are Unrealistic contract duration imposed by clients and Neighbourhood agitation against the siting of the towers. It also showed a major fear of poor monitoring and control by the contractors as a major contributing factor to the delay of telecommunication tower construction in Ghana. Delays in honouring of payment certificates, slow granting of permits by the regulators and contractor‘s financial difficulties and escalation of material prices are all causes of the delay in the construction of telecommunication towers. All these challenges or causes of delay can be mitigated by developing remedies to address them as it has been indicated in table 4.3 of chapter four (4) of this research piece. The research identified some of the remedies as choosing experienced subcontractors with a good reputation, purchasing construction materials in bulk or seeking for alternative good local substitutes of construction materials and the application of project management tools and techniques are a few that can be adopted to address the delays.

The intended framework is supposed to assist stakeholders in the construction of telecommunication towers in Ghana to enhance the effectiveness of the management of the telecommunication sector.

5.4 Recommendations

To improve on causes of delay in the construction of telecommunication towers in Ghana, the following recommendations are noteworthy.

5.4.1 Engineers

Adequate knowledge in Project Management principles, tools, and techniques, communication channels in managing construction projects is important in managing the causes of delay in telecommunication tower construction. Engineers need to have good site managers for the smooth construction of the telecommunication towers. They should plan their works properly and provide the entire schedule to clients for the smooth flow of their staff to meet the current trends in project management. The engineer also needs to ensure that adequate technical and feasibility studies have been done and managing budgets and project resources.

5.4.2 Consultants

The consultants must plan well and ensure that contract processes are duly followed, thus approval of drawings, documentation and all other things to reduce variations during construction of the telecommunication towers. They should monitor their assigned work very well by insisting that corrections are done at the appropriate time to avoid or reduce rework.

Since they serve as an intermediary to client and contractor, their skills in communication is therefore essential to help the flow of information to all contracting parties.

5.4.3 Project Managers

The project manager needs to plan, budget and oversee documentation of the construction of the telecommunication towers. There should be a close working relationship with the top management to make sure that the scope and direction of each project are on schedule, as well as other departments for support.

5.4.4 Site Acquisition and Permitting Professionals and Consultants

Site acquisition and permitting professionals and consultants must be responsible for identifying, researching, analysing and negotiating lease contracts for and zoning wireless telecommunication sites. They must negotiate lease acquisition and lease amendments required for the telecommunication tower. Landlord approval is also another important thing that they need to get before the construction of the tower. They must serve as a point of contact for the

community and engage the neighbourhoods fully to educate them about the siting of the communications cell sites.

5.4.5 Clients

Initial planning and controlling are important in order to have a proper action plan, procurement plan and budget plan prepared before starting of the project. Payment schedules must be used by contracting parties to ensure the free flow of information to avoid delay in construction of the telecommunication towers. Clients must also give advance payment to contractors so they can have some funds to mobilize for the construction works.

5.4.6 Government Regulators

Regulators should embark on an intensive public education to sensitize the public and reduce the perception and fears of diseases associated with the siting of the communication towers. This would go a long way to reduce the community agitations on the construction of the towers. Also, the regulatory authorities should make the permitting process and requirements very clear and less cumbersome to facilitate timely acquisition of relevant permits.

Finally it is recommended that future studies are carried out in the subject area that may add up or be an improvement to this subject of study.

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APPENDIX

QUESTIONNAIRE FOR RESPONDENTS

TOPIC: EVALUATING THE CAUSES OF DELAY IN THE CONSTRUCTION OF TELECOMMUNICATION TOWERS IN GHANA.

My name is Daniel Anaba and a student of Kwame Nkrumah University of Science and Technology, Kumasi Ghana. I wish to seek your views on the above-mentioned topic. This questionnaire is designed to sample views from, Telecommunication Tower Construction Contractors, Telecom Tower Project Managers, Sites Acquisition and Permitting Professionals and Consultants and Engineers working within the Tower Construction Industry. The information provided would be treated confidential and used specifically for academic purposes. The information would be key for identifying the critical causes of delays in the construction of telecommunication towers in Ghana and remedies to the causes of delay.

Section A. General Organization Information

1. Location of Organization ……

2. Professional Background (Please Tick)

A. Project Manager

B. Contractor

C. Site Acquisition and Permitting Professional

D. Site Acquisition and Permitting Consultant

E. Engineer

3. Working experience (Please Tick)

☐ 1-5 years ☐ 6-10 years ☐ 11-15 years ☐ 16 – 20 years

☐ More than 20 years

Section B: To identify the Important causes of delays in the construction of Telecommunication Towers in Ghana.

Kindly rank the following factors with respect to the above heading in section B. Use a Likert scale of 1 - 5 where one (1) is not Important: Two (2) is Moderately Important: Three (3) is Important: Four is Very Important: and Five is Extremely Important.

No.	Causes of Delays	1	2	3	4	5
1	Delays in honouring Payment certificates					
2	Unrealistic client‘s requirements					
3	Lack of tower materials in the local markets and construction materials					
4	Delays in design work and design information and contract modifications					

5	Poor workmanship leading to rework					
6	Poor site management					
7	Unethical behaviors of contractors to achieve high profits					
8	Major disputes or negotiations on site					
9	Inexperience tower construction engineers, technician or unqualified workforce					
10	Design scope changes					
11	Inadequate managerial skills for all parties					
12	Lack of quality assurance or control					
13	Poor contract management by consultant					
14	Slow granting of permits by the regualtors					
15	Improper project planning and scheduling					
16	Incompetent project team					
17	Contractor's financial difficulties and escalation of material prices					
18	Unrealistic contract durations imposed by clients					
19	Poorly defined project scope					
20	Under-estimation of project cost					
21	Poor inspection/supervision of projects					
22	Underestimation of project complexity					
23	Fluctuation of prices/rising cost of materials					
24	Variation orders					
25	Neighborhood agitation					

26	Changes in the work scope					
27	Bad weather					
28	Late in revising and approving design documents					
29	Effects of subsurface conditions such as soil, high water table etc.					
30	Mistakes and discrepancies in design documents					
31	Shortage of materials on site					
32	Late delivery of material					
33	Inadequate client's finance and payment for completed work					
34	Lack of communication between parties					
35	Mistakes during the construction stage.					
36	Improper contractor planning					
37	Changes in design during construction by the owner					
38	Project management problem					
39	Delays in sub-contractors work					
40	Poor monitoring and control					

Section C: Important Remedies that can be adopted to address delays in the Construction of Telecommunication Towers in Ghana.

Kindly rank the following factors with respect to the above heading in section B. Use a Likert scale of 1 -5 where one (1) is Not Important: Two (2) is Moderately Important: Three (3) is Important: Four is Very Important: and Five is Extremely Important.

No.	Remedies to the Causes of Delay	1	2	3	4	5
1	Revision of the bid documents such as technical specifications, drawings, bill of quantities and the design of the project to prevent discrepancy in bid documents which may lead to disputes between projects parties					

2	Making of prompt payments to contractors to avoid time overruns					
3	Contractors should ensure that there is adequate construction planning and monitoring the quality of activities continuously					
4	Monitoring the quality of work and the various activities continuously to avoid any mistakes that may lead to rework					
5	Expedite action on review and approval of design documents, preparation of payment certificates for contractors and to effect change orders early enough					
6	Ensuring that there are enough funds before awarding contracts					
7	Avoid delays in the awarding of contracts and decision-making					
8	Staying within the communication plans that have been agreed and accepted by all key stakeholders					
9	Underestimation of project time and cost should be avoided by developing a detailed WBS					
10	Initiate prompt payments					
11	Recruitment qualified personnel for effective inspections, supervisions and contract management					
12	Defining the scope of the project very clearly					
13	Not to underestimate the complexity of any project no matter the scale					
14	Identifying alternative ways of raising funds					
15	Effective site management					
16	Regulatory bodies should make the permitting process and requirements very clear to facilitate timely acquisition of relevant permits					
17	Purchasing all materials in bulk or look for very good local substitutes of construction materials					
18	Commencement of projects during dry weather conditions					
19	Frequently organize seminars, workshops and training programs for the contractors					
20	Bureaucratic channels and processes that contractors go through before their certificates are honoured be reduced					

21	Adequate allocation of contingency funds to take care of inflation and price fluctuations					
22	Early involvement of the client during the project design and planning phases to help clarify project objectives and requirements to avoid variation orders.					
23	Contract provisions which allows contractors to claim interest on delayed payments must be strictly enforced to serve as deterrent to clients					
24	Prepare effective planning and scheduling					
25	Obtaining the required approvals for the project from the relevant authorities					
26	Avoid delaying the response to contractor‘s queries as well as the approval the submitted submittals and design drawings					
27	Choosing experienced subcontractors with good reputation					

Thank You

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