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Evaluation of the Factors Influencing Time and Cost Overruns in Telecom Tower Construction in Ghana

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Abstract
This paper, sought to empirically evaluate the factors influencing time and cost overruns of the telecom tower construction projects in Ghana. It involved a cross-sectional survey that used a self-administered structured questionnaire administered to sixty seven respondents of telecom tower construction professionals. The study found 15 major factors influencing time overruns and 14 major factors causing cost overruns in telecom tower construction projects. It also revealed that telecom tower construction projects executed between 1992 and 2011 experienced as much as 82% time overruns, and the cost of the projects increased by 50%. The paper contributes to the general body of knowledge in the area of project management particularly in Ghana's construction industry. Recommendations are also made for clients, contractors and consultants to alleviate delays in the construction of telecom tower construction projects.
Keywords: cost overruns, evaluation, telecom tower construction, time overruns

1. Introduction

Telecommunication industry plays a vital role in every national economy. The industry contributes to national economy in many ways (Frempong & Atubra, 2001). It is not only building the infrastructure, Global Systems for Mobile (GSM) communications cell sites but also provides employment for the people and thus reducing unemployment in the country. Since, the tower/masts construction projects boost the economy of the every country; likewise, if the projects are not completed within scheduled and budgeted time, then their impacts are likely to be negative. The Telecommunication Network Operators (TNOs) in Ghana, according to National Communication Authority (NCA) 2010, have embarked on outsourcing of their GSM cell sites construction, and both passive and active maintenance and operations to the Mobile Telecommunication Tower Industry so as to strategically concentrate on their core functions. This has emanated an influx of telecommunication infrastructure companies in Ghana and these companies have subcontractors working on major sections of their projects. The trade liberalization has created a big opportunity for telecom tower construction and sharing business in Ghana (Frempong & Atubra, 2001).

Time and cost are crucial for both the clients and the contractors, any unanticipated delays may lead to claims and disputes, one party might sue the other. In the event of delay, if the contractor is culpable then the client seeks for monetary compensation in term of liquidated damages and the contractor will raise his claim in case the delay is caused by the client. Comprehensive site acquisition and installation process helps to deliver high quality and cost effective services to the customers. Based on rollout plan and requirements of respective companies, potential sites are located accordingly (Greens, 2004). When the projects are delayed, they may result in many effects (Faridi & El-Sayegh, 2006). These effects are mainly related to time, cost, quality and safety .To identify causes and their effects, it may not only be helpful for project managers to take preventive action but also they need to understand the situation (Sambsivan & Soon, 2007). In other case, if it is realized that the reasons which caused the time and cost overruns are client-related factors, then the managers can provide remedies to avert the effects of such problems.

The development of telecom infrastructure segment is associated with many issues like poor quality, lack of safety concerns and project delays due to inefficient project planning and control. A major problem in Ghana is the growing time overruns in the tower construction projects delivery. Although reasonable research has been conducted worldwide (Jackson, 2002 in U.K; Creedy, 2005 in Australia; Koushki, AL-Rashid & Kartam, 2005 in Kuwait; Enshassi, Al-Najjar & Kumaraswamy, 2009 in Gaza Strip; Azhar, Farooqui & Ahmed, 2008 in Pakistan; Omoregie & Radford, 2006 in Nigeria; Kaliba, Muya & Mumba, 2009 in Zambia) concerning delays and cost overruns in construction, there are no empirical studies available on time and cost overruns in telecom tower construction industry in Ghana. This development has brought about loss of clients' confidence in consultants, added investment risks, inability to deliver value to clients, and the lack of investment in the telecom

industry. There is therefore the need to conduct a research into time and cost overruns in the construction of telecom towers in Ghana. The aim of the study is to evaluate the factors influencing time and cost overruns of the telecom tower construction projects in Ghana. The following objectives have been formulated to achieve the aim: to identify the causes of variances between the initial and final schedule times at the completion of telecom infrastructure projects; to identify the causes of variances between the initial and final schedule costs at the completion of telecom infrastructure projects; and to make recommendations to improve the current phenomenon of time and cost overruns in the telecom tower construction projects.

2. The Concept of Time Overruns in the Construction Industry

A delay or time overruns is a common issue that results in monetary and time consequences in the construction industry. In Malaysia around 17.3 % of the 417 government funded construction projects were reported either delayed or abandoned in 2005 (Abudul-Rahman, Berawi, Mohamed, Othman & Yahya, 2006). The actual date of completion is invariably different from the expected date with most projects in Africa. According to Kaming, Olomolaiye, Holt and Harris (1997) time overruns is defined as the extension of time beyond planned completion dates traceable to the contractors. Vidalis and Najafi (2002) were of the view that delays are incidents that impact on a project's progress and postpone project activities; delay causing incidents may include weather delays, unavailability of resources, design delays, among many others. In general, project delays occur as a result of project activities that have both external and internal cause and affect relationship. Choudhry and Phatak (2004) defined the time overruns as the difference between the actual completion time and the estimated completion time. It is measured in number of days. Project delays are those that cause the project completion date to be delayed (Al- Gahtani & Mohan, 2007).

However, Oko, Aliu and Koleola (2010) defined 'time overrun' as the time difference between the actual and the initially planned (i.e, expected) dates of completion. It can also be defined as the duration between the date of approval of the project and its expected date of completion. Therefore, percentage time overrun can be defined as the ratio of the time overruns and the implementation phase for the project, multiplied by one hundred. Time overruns can be positive, zero or even negative. Construction program plays a vital role in delivering the project within original contract duration. Any slippage from the actual program will severely impede the project and preclude the client's objective. In Ghana, it takes about 25 to 31 days for erecting the telecommunications tower if there are no overruns (NCA, 2010).

3. The Concept of Cost Overruns in the Construction Industry

Cost overrun is the amount by which actual costs exceed the baseline or approved costs. The difference between the original cost and the actual cost when the project is completed is cost overruns. For the purpose of this research cost overrun is defined as the difference between the final or actual cost of a construction project at completion and the contract amount agreed by the client (the project owner) and the contractor during signing of the contract. Oko et al (2010) stated that percentage cost overrun for a project is defined as the ratio of the cost overrun and the initially projected cost of the project multiplied by one hundred. Again, percentage cost overrun can be positive, zero or negative. Choudhry and Phatak (2004) defined the cost overruns as the difference between the original cost estimate of project and actual construction cost on completion of works of tower construction project.

4. Empirical Studies on Time and Cost Overruns in the Construction Industry

Shehu and Akintoye (2010) studied the factors that hinder the effective implementation of the program and evaluated problems that are experienced in exercising the program management. Their findings confirmed that the main issue is the senior management's lack of commitment to the program implementation. Kazaz and Ulbeyli (2004) presented the result of a survey, which was conducted by comparing the productivity of labor with unit price analysis (UPA) system, provided by Ministry of Public Works. They distributed questionnaire to the construction professionals and asked to rate productivity of 82 work items. The findings were varying: some respondents rated low productivity while the others rated it more than the UPA.

Fuzzy logic models are used to assess uncertainty in a project. Oliveros and Fayek (2005) developed fuzzy logic model, which is more advance than previous models. It can effectively curb the issues that arise in the projects during construction related to time overrun. A study embarked by Kaliba et al (2009) explored the top five problems: late payments, client's lengthy financial process and monetary difficulties. Furthermore, variation in contract and economic issues were identified as the main causes of delay in road construction projects in Zambia. In Ghana, according to Frimpong, Oluwoye and Crawford (2003), an underground water drilling projects were delayed and the cost was increased as a result of various reasons. These reasons were related to technology, social, physical and monetary environment. Assaf and Al-Hejji (2006) conducted a field survey in Saudi Arabia. They identified 73 causes of delays, in which the significant factors of delays as ascribed by

owners, consultants and contractors where labour shortage, delay in interim payments, awarding the works to the lowest bidder, incompetent human resources, slowness in checking and approving the design documents etc.

A study carried out by Jackson (2002) in UK on building construction projects, found that poor project management, unexpected ground condition, design development, information availability, design brief, estimating method, design team performance, time limit, claims, commercial pressure, procurement route, external factor and people were the causes of cost overruns. In Ghana, Frimpong et al (2003) studied 26 factors that cause cost overruns in construction of ground water projects in Ghana; they sent 55 questionnaires to owners, 40 to contractors and 30 to consultant. According to the contractors and consultants, monthly payments difficulties from agencies was the most important cost overruns factor, while owners ranked poor contractor management as the most important factor. Despite some difference in viewpoint held by the three groups he surveyed, there was a high degree of agreement among them with respect to their ranking of the factors. In Nigeria, Omoregie and Radford (2006) studied the Nigeria infrastructure projects and found out that the causes were price fluctuation, financing and payment for completed work, poor contract management, delay, change in site condition, inaccurate estimate, shortage of materials, imported materials and plant items, additional works and design changes. In Zambia, Kaliba et al (2009) conducted an empirical study in Zambia Road construction projects and revealed that Bad weather, inflation, schedule delay, scope changes, local government pressures, strikes, technical challenges and environmental protection and mitigation.

In Kuwait, Koushki et al (2005) studied Kuwait Private residential projects, government initiative by rail, material cost increase, material cost increase and contract failure. In Gaza Strip, Enshassi et al (2009) researched on Gaza Strip Construction projects and their findings were increment of materials prices due to boarder closures, delay in construction, supply of raw materials and equipment, fluctuation in the cost of building materials, project materials monopoly by some suppliers, unsettlement of local currency in relation to dollar value, design changes, contractual claims, inaccurate quantity take-off; lack of cost planning/monitoring during pre and post contract stages and resources. In Pakistan, Azhar et al (2008) researched into the Pakistan Construction projects and discovered Fluctuation in prices of raw materials, unstable cost of manufactured materials, fraudulent practices and corruption, mode of financing and payment for completed work. Finally, inadequate quality/Ambiguity of contract documents, inappropriate contractual policies and poor project (site) management/poor cost control were the Significant Factors Causing Cost Overrun.

5. Telecom Tower construction

There are five types of telecom towers, which are: *self standing telecom tower structure* which consists of latticed elements bolted or welded together to form a tower with a conical or prismatic structure. Lattice components of these towers may be made of angular or tubular section components; *guyed tower or mast* which is basically a perfectly vertical and perpendicular mast that is held in position by strong guying cables that are located at regular intervals around the circumference of the tower. Guyed Towers use very little space for their foundation, but may need more land overall to account for the guy cable anchors that are located at a distance from the tower. Guyed masts are available at lower cost in comparison to self supported towers; the other category of mobile telecommunications towers is *Cell on Wheels* (COW) which are designed to respond to a need for rapid deployment of telecommunications system and it provides quick, convenient communications capabilities for short or long term use without the hassle of installing permanent foundations, costly construction and regulatory restrictions; *reinforced concrete towers* are adopted when certain critical piece of telecom networks need highly sturdy and secure support. Reinforced towers at many places are made in the form of a proper building that can house an office that monitors the working of the antenna from within it; *mobile telecom towers* also form a part of the overall telecom tower infrastructure and may be used on a temporary basis in areas that recover good signal coverage.

In the market, there are various classifications of mobile telecommunications towers based on: (i) cross section of telecommunications tower (Square Towers, Triangular Towers, and Delta Towers), (ii) type of material sections (Tubular Towers [see Figure 1], Angular Towers [see Figure 2], Hybrid Towers), and (iii) placement of telecommunications tower (Ground Based Towers or Greenfield Towers, Roof Top Towers).

Figure 1: legged Tubular Tower

Source: www.fotosearch.com

Figure 2: Legged Angular Tower

Source: www.fotosearch.com

The process of constructing telecommunication towers includes: design and manufacture of telecom towers and monopoles; site clearing and leveling; earthworks; tower grounding cell tower erection; supply and installation of fully equipped shelters delivering electricity, air conditioning and security protection; supply and commissioning of generators; site fencing and protection.

6. Methodology

6.1 Research design

The design used for this study was that of survey which relied on questionnaire and interview to generate data for the analysis. The study was to evaluate the factors influencing time and cost overruns of the telecom tower construction projects in Ghana.

6.2 Population and sampling

The population for the study included consultants/engineers (36), contractors (15) and clients 'top management of telecom network operators' (16). The total population for the study was sixty seven (67). Since the population was small, it was necessary to use census technique. According to Jothikumar (2005), census is a method of sampling where every element of the population is included in the investigation. This ensures that the data are collected from each and every item of the population and the results are more accurate and reliable, because every item of the universe is required.

6.3 Instrument and data collection

Questionnaire was used for the study. The questionnaire items were based on the demographic of the respondents, project related factors, contractor related factors, client related factors and consultant related factors leading to time overruns for constructing telecom towers/masts. The questionnaire was personally administered by the researchers and that gave them the opportunity to interact with the respondents. The researchers explained in details the rationale for the research and gave explanations where necessary. Enough time was given to the respondents to answer the questionnaire. However, some were collected on the same day and others after a few days.67 questionnaires were distributed out of which 50 were returned, representing 75% response rate. A five-point weighing scale was used to indicate the relative importance of a contributor in a construction time and cost overruns, where "5" represented *extremely significant*; "4" *very significant*; "3" *moderately significant*; "2" *significant*; and "1" *not significant*. A factor rated "4" or "5" was interpreted as a significant contributor of construction delay, the one rated "1" or "2" was interpreted as an insignificant contributor of construction delay, while that with a "3" was taken as uncertain. An interview was also carried out with the experts and professionals at the various sites, and the participants in the interviews were all from the junior, senior and middle management.

6.4 Data Analysis

The data obtained were analyzed using Statistical Package for Social Sciences (S.P.S.S) version 19.0. Relative Important Index was used to calculate the relative importance of each criterion and to aid in making comparison. Analysis of the collected data was conducted for different groups of factors and were ranked according to the level of importance that each of the four groups of factors attached to the causes of time and cost overruns.

6.5 Relative Importance Index

The relative importance index (RII) used to indicate the relative importance of each variable contributing to the telecom tower construction time and cost overruns was calculated with the formula below:

$$RII = \frac{\Sigma W}{A \times N} \quad (1)$$

Where: W - scale for rating a factor (ranges from 1 to 5); A – is the highest weight in the scale; N – is the total number of respondents.

7. Results and Discussions

7.1 Factors Causing Time Overrun In Telecom Tower Construction Projects

The results of the factors influencing time overruns in telecom tower construction projects are presented in Table 1. The results are discussed under project related factors causing time overruns, contractor related factors causing time overruns and consultant related factors causing time overruns in telecom tower construction projects.

Table 1: Factors Influencing Time Overruns in Telecom Tower Construction

PARAMETER	RESPONSES (RANKING)					TOTAL	∑W	MEAN	RII	RANK
	1	2	3	4	5					
Client Related factors										
Clients delay of payment certificates	6	8	4	12	20	50	182	3.640	1.255	1st
Unrealistic clients requirements	7	7	5	14	17	50	177	3.540	1.221	2nd
Lack of tower materials in the local markets	10	3	9	8	20	50	175	3.500	1.207	3rd
Delays in design work and design information	10	8	8	12	13	50	163	3.260	1.124	4th
Contract modifications	10	7	10	8	15	50	161	3.220	1.110	5th
Late arrival of shipment of materials from abroad	11	12	3	12	13	50	157	3.140	1.083	6th
Absence of efficient project progress tracking	10	4	11	12	13	50	156	3.120	1.076	7th
Contractor Related factors										
Poor workmanship leading to rework	5	11	10	14	19	50	208	4.160	1.434	1st
Poor site Management	1	2	17	12	18	50	194	3.880	1.338	2nd
Unethical behaviors of contractors to achieve high profits	1	9	9	12	19	50	189	3.780	1.303	3rd
Uncompromising attitudes between parties	2	8	10	15	15	50	183	3.660	1.262	4th
Major disputes/ negotiations on site	12	7	2	15	16	50	172	3.440	1.186	5th
Inexperience tower construction engineers/technician	10	5	8	11	16	50	168	3.360	1.159	6th
Low productivity of labor	13	6	7	8	16	50	158	3.160	1.090	7th
Lack of quality assurance/control	10	7	13	10	10	50	153	3.060	1.055	8th
Delays in preparation of Interim certificates	12	8	8	10	12	50	152	3.040	1.048	9th
Poor subcontractor selection processes	12	10	8	4	16	50	152	3.040	1.048	10th
Little periodical sessions to address work problems	9	11	10	5	14	50	151	3.020	1.041	11th
Centralization of decision making process of client	12	12	5	7	14	50	149	2.980	1.028	12th
Consultant related factors										
Design scope changes	1	9	9	12	19	50	189	3.780	1.303	1st
Lack of quality assurance / control	2	8	10	15	15	50	183	3.660	1.262	2nd
Inadequate managerial skills for all parties	7	7	5	14	17	50	177	3.540	1.221	3rd
Poor contract management by consultant	12	7	2	15	16	50	172	3.440	1.186	4th

Lack of job security for consultants team	10	7	10	8	15	50	161	3.220	1.110	5th
Governmental Policies and requirement needs	12	1	10	9	19	50	106	2.655	0.731	6th
Inappropriate construction method	12	6	8	8	16	50	101	2.483	0.697	7th

7.1.1 Clients Related Factors

Results in Table 1 indicate that inadequate construction planning; delays in payment; discrepancies in contract documents; poor quality control; and unexpected management condition were the main causes of time overruns. The results also indicate high importance of work continuity to complete the project on time. With reference to the Table 1, the clients or project owners ranked clients delay of payment certificates at first (1st) position as the major cause of time overrun with Relative Importance Index (RII) of 1.255, followed by unrealistic clients requirements which was ranked second (2nd) position with RII of 1.221, lack of tower materials in the local markets was ranked third (3rd) with RII of 1.207, delays in design work and design information was ranked fourth (4th) with RII of 1.124, and contract modifications which was ranked fifth (5th) with RII of 1.110. These factors have Relative Importance Indexes of more than 1.1, and are all major clients' related factors affecting time overrun or delays in telecom tower projects.

Though the clients are the initiators of the construction of telecom tower projects, they have their own challenges which invariably affect the time of completion of the project. The result implies that the clients delay in the payment of work done is the major or highest ranked client related factor that affects the time overruns of constructing telecom tower projects followed by unrealistic client's requirements and lack of tower materials in the local market. The results of this study have many similarities with Omoregie and Radford (2006) study in Nigeria on infrastructure projects which found that the causes of delays in construction works were price fluctuation, delays in payment of completed work, poor contract management, among others. Another study conducted by Kaliba et al (2009) explored the top five problems in the road construction projects in Zambia as: late payments, client's lengthy financial process and monetary difficulties. Furthermore, variation in contract and economic issues were identified as the main causes of delay. In contrast, a study conducted in Kuwait by Koushki et al (2005) examined the causes of delays in private residential projects. They found that variation orders, and incompetence of the owners were the major causes of time overrun.

7.1.2 Contractor Related Factors

The result as presented in Table 1, the contractor related factors that were associated with time overrun in telecommunication tower construction were as follows: poor workmanship leading to rework was ranked first (1st) with Relative Importance Index (RII) of 1.434, which depicts how important this variable is to the project and therefore cannot be gloss over. Poor site management ranked second (2nd) with RII of 1.338, which means that contractors must ensure effective site management. Unethical behaviors of contractors to achieve higher profits ranked third (3rd) with RII of 1.303. Interestingly, uncompromising attitudes between parties was ranked fourth (4th) with RII of 1.262. Major disputes/negotiations on sites with RII of 1.18 was ranked fifth (5th) and inexperienced tower construction engineers/technicians was also ranked sixth (6th) with RII of 1.159. These factors have Relative Importance Indexes of more than 1.1, and are all major contractors' related factors affecting time overrun or delays in telecom tower projects in Ghana. The result indicates that poor workmanship is the highest ranked contractor related factor which affects the time overruns of telecom tower construction project as well as poor site management. In the study of Alwi and Hampson (2002), poor site management, was also considered a major factor influencing time overrun which is consistence with the findings of this study.

7.1.3 Consultants Related Factors

Table 1 presents the responses from consultants on the factors that influence the time overruns of telecom tower construction projects. Design scope changes was ranked first (1st) with Relative Importance Index (RII) of 1.303, lack of quality assurance/control was ranked second (2nd) with RII of 1.262. Next on the list of factors were inadequate managerial skills for all parties which was ranked third (3rd) with RII of 1.221, poor contract management by consultant was ranked fourth (4th) with RII of 1.186 and lack of job security for consultant's team ranked fifth (5th) with RII of 1.110. All the factors had Relative Importance Indexes of more than 1.1, and are all major consultants' related factors affecting time overrun or delays in telecom tower projects. According to the result, the highest ranked consultant related factor for delays in construction of telecom towers is the design scope changes (thus changes in the drawings) which is followed by lack of quality assurance/control. This finding is parallel with the findings of Faridi and El-Sayegh (2006), who investigated the causes of delays that severely influenced the construction projects in UAE. Their study ranked the preparation of drawings and approval of drawings as highest among delays that were caused by consultants. The consultants sometimes provide drawings to contractors for construction but usually the drawings are incomplete and many important details are missing. It takes more time to get the required information that impact negatively on the progress of

the work thereby causing delays.

7.2 Factors Influencing Cost Overruns in Telecom Tower Construction Projects

From Table 2, the results of the factors which are associated with variance between the initial cost and the final cost in telecom tower construction projects are presented. The respondents (clients, contractors and consultants) were required to rank the variables according to their perceived significance level as contributing factor to cost overruns in telecom tower construction projects.

Table 2: Factors Influencing Cost Overruns in Telecom Tower Construction

PARAMETER	RESPONSES (RANKING)					TOTAL	∑W	MEAN	RII	RANK
	1	2	3	4	5					
Client Related factors										
Poor planning and control	0	2	6	21	21	50	211	4.220	1.455	1st
Price fluctuations	1	1	8	18	22	50	209	4.180	1.441	2nd
Ineffective cost control systems	1	8	7	18	19	50	205	4.100	1.414	3rd
Lack of coordination at design phase	0	3	13	19	15	50	196	3.920	1.352	4th
Design scope changes	1	4	12	15	18	50	195	3.900	1.345	5th
Inadequate review of drawings and contract documents	2	5	9	23	11	50	186	3.720	1.283	6th
Contractor Related factors										
Frequent breakdowns of plant and Equipment	0	13	6	17	14	50	182	3.640	1.255	1st
Deficiencies in prepared cost estimates	1	5	10	15	19	50	186	3.720	1.283	2nd
Planning and Scheduling deficiencies	3	10	13	13	11	50	169	3.380	1.166	3rd
Omissions and errors in bills	10	8	10	10	12	50	156	3.120	1.076	4th
Inaccurate quantity take off	10	12	11	10	9	50	152	3.040	1.048	5th
Poor contract management	20	6	10	7	7	50	125	2.500	0.862	6th
Consultant related factors										
Inadequate project preparation, planning and implementation	11	1	8	12	18	50	175	3.500	1.207	1st
Delay in issuing information to the contractor during construction	12	2	9	10	17	50	168	3.360	1.159	2nd
Lack of cost planning /monitoring during pre- and post contract stages	10	3	12	8	16	50	164	3.280	1.131	3rd
Delays in costing variations and additional works	11	3	14	7	15	50	162	3.240	1.117	4th
Lack of cost reports during project	15	8	10	7	12	50	149	2.980	1.028	5th

7.2.1 Client Related Factors

The client related group identified dominant variables that influenced cost overruns with a Relative Importance Index (RII) equal to or more than 1.1. The individual variables were ranked as following: poor work planning and control was ranked first (1st) with RII of 1.455; price fluctuation in the cost of materials was ranked second (2nd) with RII of 1.441, which is in consonance with the findings of Azhar et al (2008) which was ranked first in their study; ineffective cost control systems was ranked third (3rd) with RII of 1.414; lack of coordination at design stage was ranked fourth (4th) with RII of 1.352; design scope changes was ranked fifth (5th) with RII of 1.345; and inadequate review of drawings and contract documents was also ranked sixth (6th) with RII of 1.283.

The result suggests that the highest ranked client related factor for cost overruns is poor work planning and control, as well as price fluctuation in the cost of materials, ineffective cost control systems, lack of coordination at design stage, design scope changes and inadequate review of drawings and contract documents. This result has many similarities with Enshassi et al (2009) study on Gaza Strip Construction projects which found that increment of materials prices, delay in supply of raw materials and equipment, fluctuation in the cost of building materials, design changes, inaccurate quantity take-off, lack of planning/monitoring, among others. Another study that has link with the findings of the current study is the study by Azhar et al (2008), who researched into the Pakistan Construction projects and discovered fluctuation in prices of raw materials, unstable cost of manufactured materials, inadequate quality/ambiguity of contract documents, inappropriate contractual policies

and poor project (site) management as the significant factors causing cost overrun.

7.2.2 Contractor Related Factors

The contractor related factors for cost overruns in telecom tower construction projects are; frequent breakdowns of construction plant and equipment which was ranked first (1st) with RII of 1.255, deficiencies in prepared cost estimates was ranked second (2nd) with RII of 1.283, planning and scheduling deficiencies was ranked third (3rd) with RII of 1.166, omissions and errors in bills of quantities was ranked fourth (4th) with RII of 1.076, inaccurate taking-off was ranked fifth (5th) with RII of 1.048, and poor contract management was also ranked sixth (6th) with RII of 0.862.

The highest ranked factor of contractors contributing to the cost overruns of telecom tower construction project is frequent breakdowns of construction plant and equipment, as well as deficiencies in prepared cost estimates, planning and scheduling deficiencies, inaccurate taking-off and poor contract management. These findings also have many similarities with the findings of Enshassi et al (2009). In contrast, study by Aibinu and Jagboro (2002) found that delays in land acquisition, shifting of utilities, environmental and inter-ministerial clearances, shortage of funds, litigations over land acquisition and contractual disputes are the major causes behind the cost overruns of building project.

7.2.3 Consultant Related Factors

Under the consultant related factors, inadequate project preparation, planning and implementation was ranked first (1st) with RII of 1.207, delay in issuing information to contractor during construction was ranked second (2nd) with RII of 1.159, lack of cost planning /monitoring during pre and post contract stage was ranked third (3rd) with RII of 1.131, delays in costing variations and additional works was ranked fourth (4th) with RII of 1.117, and lack of cost reports during construction was ranked fifth (5th) with RII of 1.028.

The result indicates that the highest consultant related factor of cost overruns of telecom tower construction projects is inadequate project preparation, planning and implementation, followed by delay in issuing information to contractor during construction, lack of cost planning /monitoring, delays in costing variations and additional and lack of cost reports during construction. These findings also have many similarities with the studies of Enshassi et al (2009) and Azhar et al (2008).

Cost overruns could bring about project abandonment and a drop in building activities, bad reputation, and inability to secure project finance or securing it at higher costs due to added risks. All these consequences undermine the viability and sustainability of the construction industry. According to Arditi, Akan and Gurdamar (1985), the effect of cost overrun is not only confined to the construction industry but also reflects in the state of the overalls economy of a country.

8. Findings from the Interviews: Helios Towers /Tigo Ghana

The interview conducted with the professionals from the Helios towers/Tigo Ghana brought to light the number of telecom towers constructed between 1992 and 2011, location and percentage time and cost overruns that affected the projects. These projects experienced terrifying rate of time and cost overruns. On the average 35% to 55% of the projects experienced 82% time overruns and 25% to 35% experienced 40% cost overruns. Averagely, a cell site or a tower should takes twenty four (24) to thirty (30) days to complete but ends up being completed between 36 to 40 days. The average cost of constructing a tower is GH¢ 120,000.00 but after 40 days it cost GH¢ 180,000.00. From the interview, it was revealed that each party blames the other for causes of time and cost overruns.

From the clients' point of view most of the time consultants are responsible for causing the problem, project owners believe that had the designs, specifications and contract documents been done and prepared correctly from the start, there wouldn't have been late change orders and 'unexpected ground conditions', etc. From the consultant's point of view it is the project owners that initiate late changes and hence it is the client who is responsible for initiating time and cost overrun most of the time. Government Regulatory authorities, such as National Communication Authority (NCA) in most cases do not issue permit or approval to contractors to commence the works in reasonable time. The slow granting of permits by government agencies was the first factor contributed to delays as revealed during the interview by the management.

This result shows that some laws to give permission to start work is difficult, as well as regulations of government in issuing permission, or facilitate transactions contribute to the delay of project. In UAE, Faridi and El-Sayegh (2006) study found that delays in obtaining permit was a key factor to the delays in construction projects and ranked it first (1st) according to perception of participants of the survey. NCA Act (2010) in Ghana which governs the construction of new towers and maintenance of existing towers, stipulate that a new tower must be approved subject to height and weight requirements, location, environmental impact and various other factors. Furthermore, the Act also state that each existing tower is inspected and expected to meet stringent standards and maintenance requirements, which may necessitate capital expenditures and fees related to upkeep and compliance.

9. Conclusion and Recommendation

9.1 Conclusion

The study found fifteen (15) major factors influencing time overruns in telecom tower construction projects in Ghana according to the respondents (clients, contractors and consultants). These factors are clients' delay of payment certificates, unrealistic clients' requirements, lack of tower materials in the local markets, delays in design work and design information and contract modifications. In addition, poor workmanship leading to rework, poor site management, unethical behaviors of contractors to achieve high profits, uncompromising attitudes between parties, major disputes/negotiations on site and inexperience tower construction engineers/technician. Finally, design scope changes, lack of quality assurance/control, inadequate managerial skills for all parties and poor contract management by consultant. Interview conducted with the professionals from the Helios towers/Tigo Ghana revealed that telecom tower construction projects experienced terrifying rate of time overruns, thus on the average 35% to 55% of the projects executed between 1992 and 2011 experienced 82% time overruns. Additionally, the slow granting of permits by NCA was also identified as a factor contributing to delays during the interview by the management.

The following findings (14 factors) have emerged from the responses elicited from the respondents as the major factors influencing the cost overruns of telecom construction projects in Ghana. Firstly, poor planning and control, price fluctuations, ineffective cost control systems, lack of coordination at design phase, design scope changes, and inadequate review of drawings and contract documents. Secondly, frequent breakdowns of plant and equipment, deficiencies in prepared cost estimates, and planning and scheduling deficiencies. Lastly, inadequate project preparation, planning and implementation, delay in issuing information to the contractor during construction, lack of cost planning/monitoring during pre and post contract stages, and delays in costing variations and additional works. The average cost of constructing a tower is GH₵ 120,000.00, but sometimes it ends up costing GH₵ 180,000.00 according to the interview conducted with the professionals from the Helios towers/Tigo Ghana, resulting in the increased of the cost of the project by 50%.

9.2Recommendation

Based on the findings of the study, it is recommended that clients of telecom tower construction projects should regularly revise the bid documents such as technical specifications, drawings, bill of quantities and the design of the project to obviate discrepancy in bid documents which may lead to disputes between projects parties and to make prompt payment to the contractor to avoid time overruns in the projects. Additionally, it is recommended that contractors should ensure adequate construction planning, monitor the quality of activities continuously, set up stores for required construction materials, and to have the ability for controlling most project activities, and used approved materials and procedure of work to alleviate time and cost overruns of the telecom construction projects.

It is again recommended that consultants should monitor the quality of work in various activities continuously so as to avoid any mistakes that may lead to rework. They should also expedite action on review and approval of design documents, preparation of payment of certificates for contractors and to effect change orders early enough. Finally, it is recommended that further research works need to be carried out on: enhancing quality and productivity improvement to minimize time and cost overruns on telecom tower construction projects; the application of six sigma method to improve quality and productivity of telecom tower construction; development of a Total Quality Management Model to mitigate effects of time and cost overruns in telecom tower construction projects; and to examine the impact of health, safety and environmental management systems on time and cost overruns in telecom tower construction projects.

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