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Causes of Delays in Highway Construction Projects in Ghana

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Abstract

Delays in construction projects are a global phenomenon, causing a multitude of negative effects on the key project participants – clients, consultants, and contractors. The main purpose of this study is to identify the causes of delay of highway construction projects in Ghana to determine the most important to the key project participants. Literature review and semi-structured interviews of 12 key players in the implementation process were conducted. Thirty five possible causes of delay were identified and further grouped into ten categories. A questionnaire survey was conducted on the resulting list of delay causes for the identification of the most important causes of delay. The relative importance of the individual causes were determined and ranked by their Relative Importance Index. The findings revealed that the five most important causes of delay in road construction projects in Ghana are 1) Delay in honouring payment certificates 2) Equipment failure 3) Shortage of materials 4) Poor site management 5) Late delivery of materials on site. It is hoped that the findings of this paper will help project participants to act on critical causes to minimize delay of their projects.

Key Words: Highway construction projects, Ghana, Relative Importance Index.

1. Introduction

Delays on construction projects are a universal phenomenon. Often, circumstances beyond the contractor's control, which could not have been reasonably anticipated at the time of tendering, lead to delays. These delays make it impossible to meet the project completion date (Daniel W, Halpin, 2005). Delays are always accompanied by cost and time overrun. Construction project delays have a debilitating effect on the parties (owner, consultant, and contractor) to a contract in terms of growth in adversarial relationships, distrust, litigation arbitration, cash-flow problems, and a general feeling of apprehension towards each other (Megha Desai, Rajiv Bhatt, 2013).

To some extent the contract parties through claims usually agree upon the extra cost and time extension associated with delay. Nevertheless this has in many cases given rise to heated arguments between the owner and contractor. The question of whether a particular delay to progress of work warrants an extra cost and or extension of project duration is usually the cause of disagreement. Such situations usually involve questioning the facts, causal factors and contract interpretation, which have been addressed by Alkass et al (1996); and Bordoli and Baldwin (1998).

Construction delay is a major problem facing the Ghanaian construction industry. It is endemic and its economic and social impact is often discussed (Fugar D.K et al 2010). Frimpong and Oluwoye (2003), investigated the significant factors that cause delay and cost over-runs in underground projects in Ghana. They indicated that owners, consultants and contractors agreed that project financing, economic and natural conditions and material supply were the four major categories of causes of delay and cost over-run factors.

Fugar et al 2010 also studied the causes of delay in building construction projects in Ghana and reported that all the three groups of respondents generally agreed that out of a total of 32 factors, the top four major factors causing delay are: 1) delay in honouring payment certificates 2) underestimation of the costs of projects 3) underestimation of the complexity of projects 4) difficulty in assessing bank credit. These researchers leave a gap which the current study sought to fill, namely to find the causes of delay in road construction projects in Ghana.

The construction industry is an important sector of the Ghanaian economy. It contributes an average of 8.5% of the gross Domestic Product (Ghana Statistical Services 2007). It employed about 2.3% of the economically active population in 2002 (Amankwa, 2003). The huge volume and complexity of projects in the Ghanaian construction industry pose a great challenge and provide a wealth of opportunities to various companies in the construction industry.

The government of Ghana, as in many countries, is the major developer of roads and therefore dominates the economic viability of the road industry. Millions of Ghana cedis is committed to the construction of roads annually through budgetary allocation, donor funded projects and Foreign Direct Investment. It is against this

background that investigating the factors responsible for delay in road construction projects and recommending measures to avoid or mitigate them assume tremendous importance.

2. Objectives of the study:

The main objectives of this study include:

- To identify the major causes of delay of road construction projects in the Ghanaian context using an opinion survey
- To ascertain the perceptions of the key project participants (client, consultant, contractor) regarding the causes of delay
- To suggest possible ways of avoiding or mitigating them

3. Literature Review

A number of studies have been carried out to determine the causes of delay in construction projects. In the study of Assaf and Al-Hejji, (2006) construction delay was defined as "the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project". Delay was also defined as "an event that causes extended time to complete all or part of a project" (Sanders and Eagles, 2001). The type of delay focused on in this study is time overrun beyond the date for completion specified in the condition of contract not considering whether an extension of time has been granted.

Chan and Kamaraswamy, (1997) studied delays in Hong Kong construction industry. They emphasized that timely delivery of projects within budget and to the level of quality standard specified by the client is an index of successful project delivery. Failure to achieve targeted time, budgeted cost and specified quality result in various unexpected negative effects on the projects. Normally, when the projects are delayed, they are either extended or accelerated and therefore, incur additional cost. Questions arise as to the causes of delay and the assigning of faults often evolves into disputes and litigation (Bolton, 1990).

After becoming aware of a delay, and recognizing the potential impacts, the prudent owner or contractor will determine who is responsible for the delay. From the perspective of identifying responsibility there are three categories of delay in government contracting, namely 1) Excusable delay 2), Inexcusable delay 3), Compensable delay (Don Owen, 1997).

Excusable delay is delay for which a contractor is entitled to a time extension but no monetary compensable. This category of delay is considered to be outside the owner or contractor's control.

Inexcusable delay is delay for which the contractor is not entitled to time extension or monetary compensation. This is delay for which the contractor assumes responsibility.

Compensable delay is delay for which the contractor is entitled to both a time extension and an increase in the contract sum. It is delay caused by acts or omissions of the client.

Abd El-Razek et al, (2008) studied the causes of delays in building construction projects in Egypt and concluded that the most important causes of delay are financing by contractor during construction, partial payments during construction, and non-utilization of professional contractual management. About a decade earlier, Odeyinka and Yusif, (1997) studied the causes and effects of construction delays on completion cost of housing projects in Nigeria. They classified the causes of delay as project participants and extraneous factors. Client-related delays include variation orders, slow decision making and cash flow problems. Contractor-related delays identified include financial difficulties, material mismanagement, poor planning and scheduling, inadequate site inspection, equipment management problems, and shortage of manpower. Extraneous causes of delay identified were inclement weather, acts of nature, labour disputes and strikes.

Ayman, (2000) investigated the causes of delays on 130 public projects in Jordan. The projects included residential, office and administration buildings, school buildings, medical centers and communication facilities. The results indicated that the main causes of delay in construction of public projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions, and increase in quantity. Eight years later, Sweis et al., (2008) also conducted a similar study into the causes of delay in residential projects in Jordan and concluded that financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. It is however interesting to note that designers as a major factor of delay on projects in Jordan was not reported again as a major factor in the Sweis et al., (2008) study.

A similar study in Malaysia by Alagbari, Kadir, Salim, and Ernawati, (2007) indicated that clients, contractors and consultants agreed that financial problems were the main factors and coordination problems were the second most important factor causing delay in construction projects in Malaysia.

Chan and Kumaraswamy, (1998) conducted a survey to evaluate the relative importance of 83 potential delay factors in Hong Kong construction projects and found five principal factors: poor risk management and supervision, unforeseen site conditions, slow decision making, client- initiated variations, and work variations. They also found that there was a difference in perceptions as to causes of delays by different groups of participants in building and civil engineering works. They suggested that biases of different industry groups might direct blame for delays to other groups.

Manavazhia and Adhikarib, (2002) conducted a survey to investigate material and equipment procurement delays in highway projects in Nepal. Delay in the delivery of materials and equipment to construction sites is often a contributory cause to cost overruns in construction projects in developing countries. An assessment of the causes of the delays and the magnitude of their impact on project costs were also made. The main causes of material and equipment procurement delays were found to be (in rank order) organisational weaknesses, suppliers' default, governmental regulations and transportation delays.

This review has underscored that the factors that cause delay in construction projects are many and vary from one country to another. However, in developing economies, Ogunlana et al., (1996) have reported that there are distinctive problems that cause delays in construction. They have classified them into three groups: (1) problems of shortage or inadequacies in industry infrastructure (mainly supply of resources), (2) problems caused by clients and consultants, and (3) problems caused by contractor incompetence.

4. Methodology

The research methodology involves two phases. The first phase consisted of literature search for information in the construction industry on the causes of delay in highway construction projects and non-structured interviews. The literature search was conducted through books, journals, conference proceedings and the internet. A small pilot study was conducted using 10 each of clients, consultants and contractors. The main purpose of the pilot study was essentially to validate a preliminary set of construction delay causes obtained from literature and to determine from their experience other factors which cause construction delay in Ghana. The outcome of this phase is the identification of 35 causes of delay.

The second phase involved the development of questionnaire incorporating the 35 causes of delay identified and data collection. The questionnaire was organized in the form of an importance scale. The respondents were asked to indicate by ticking a column the relative importance of each of the causes of construction delay (in terms of 4 = "very important", 3 = "important", 2 = "somewhat important", 1 = "not important"), (Fugar et al, 2006). The sampling method used in this study was convenience and snowball sampling. This sampling comes under the class of non-probability sampling techniques. The sample elements were identified by convenience and through referred networks. This method of sampling is preferred when it is difficult to get response from sample elements selected at random (Sambasivan et al, 2007). The questionnaires were distributed through friends working in the road agencies, consultancies and construction firms. The questionnaires were collected back at appointed times.

Table 1. Percentage of questionnaires distributed and responses received

Respondents	Questionnaires Distributed	Responses returned	Percentage of Responses
Clients	45	42	33%
Consultants	45	43	42%
Contractors	45	40	32%
Total	135	125	93%

This sampling method enabled a large number of completed questionnaires to be collected back timely and efficiently. A total of 135 questionnaires were distributed to respondents in the Greater Accra Region of Ghana where the concentration of project participants are high. 45 questionnaires were dispensed to each category of the respondents – clients, consultants, and contractors. Out of the 135 questionnaires distributed, 125 sets (93%)

were received for analysis out of which 42 (33%) were responses from clients, 43 (34%) were responses from consultants, 40 (32%) were responses from contractors.

4.1. Data Analysis

Fagbenle et al, (2004) used the relative importance index method to establish the relative importance of the various factors identified as responsible for construction delay. The same method was adopted in this study within the various groups of respondents – clients, consultants, and contractors. The score for each factor is computed by summing up the scores given to it by the respondents. The Relative Importance Index (RII) was computed using the following formula:

$$RII = \frac{\sum PiUi}{N(n)} \quad (1)$$

Where,

RII = Relative Importance Index

$P_{i=}$ respondent's rating of cause of delay

$U_{i=}$ number of respondents placing identical weighting on cause of delay

N = sample size

n = the highest attainable score on cause of delay

4.2. Agreement Analysis

The Spearman's rank correlation coefficient was used to check the degree of agreement between the rankings of any 2 parties. Spearman's rank correlation coefficient is a non-parametric test. Non-parametric tests are also referred to as distribution-free tests. These tests do not require the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than the means and as a result if the data have one or two outliners, their influence is negated. In this research, the correlation coefficient is used to show the degree of agreement between the different parties. The correlation coefficient varies between -1 and +1, where +1 implies a perfect positive relationship (agreement), while -1 results from a perfect negative relationship (disagreement). The result is interpreted as: If the rank is close to -1 implies negative correlation, close to 0 implies no linear correlation and close to +1 implies positive of good correlation. The Spearman's rank correlation coefficient (ρ) was calculated from the formula:

$$P = 1 - \frac{6\sum d^2}{n^3 - n} \quad (2)$$

Where,

d = the difference between the ranks given by any two respondents for an individual cause

n = the number of causes or groups, which in this case is 35 causes or 10 groups.

The rank correlation coefficient between client and consultant 0.61, between client and contractor is 0.52, between consultant and contractor is 0.58. This shows that they all exhibit strongly positive correlation.

5. Results

The responses to the questionnaires were subjected to Relative Importance Index (RII) and spearman's rank correlation tests and the results are presented in Table 2. The RII value has a range from 0 to 1 (0 not inclusive), the higher the value of RII, the more important is the delay factor. The RII for all the causes of delay and groups was calculated using equation (1). The indexes were ranked for all the respondents and the group index which is the average of the RII of the causes of delay in each group was also determined.

Table 2: Relative Importance Index and Rank of Delay Factors

	Clients		Consultant		Contractor		Average	Overall
Causes of Delay	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Delay in honouring payment certificates	0.831	4	0.917	1	0.942	4	0.897	1
Equipment failure or breakdown	0.903	1	0.833	7	0.949	3	0.895	2
Shortages of materials on site or market	0.798	7	0.901	2	0.975	1	0.891	3
Poor site management	0.855	2	0.848	4	0.901	8	0.868	4
Late delivery of materials on site	0.839	3	0.788	18	0.967	2	0.865	5
Improper construction methods	0.791	7	0.788	10	0.942	4	0.840	6
Poor design	0.734	18	0.864	3	0.908	9	0.835	7
Foundations conditions encountered on site	0.774	14	0.812	9	0.917	8	0.834	8
Underestimation of costs of projects	0.789	9	0.811	8	0.901	8	0.834	8
Poor supervision	0.798	7	0.811	9	0.867	15	0.825	10
Relocation of utilities	0.791	11	0.848	4	0.825	21	0.821	11
Underestimation of complexity of projects	0.758	12	0.795	10	0.875	11	0.809	12
Insufficient communication between parties	0.734	18	0.788	16	0.875	13	0.799	13
Legal disputes	0.742	17	0.795	14	0.851	17	0.796	14
Lack of programme of works	0.806	5	0.636	21	0.942	4	0.795	15
Underestimation of time of completion	0.806	5	0.818	7	0.758	18	0.794	16
Mistakes in soil investigations	0.694	27	0.749	23	0.901	10	0.781	17
Shortage of skilled labour	0.718	23	0.674	28	0.942	4	0.778	18
Client initiated variations	0.774	14	0.803	14	0.758	26	0.778	18
Fluctuations in prices	0.798	7	0.841	6	0.692	30	0.777	20
Bad weather conditions	0.734	20	0.781	21	0.817	23	0.777	20
Poor professional management	0.798	7	0.621	32	0.851	17	0.757	22
Delays in obtaining permit from municipality	0.694	27	0.742	24	0.833	21	0.756	23
Necessary variations	0.629	31	0.751	22	0.875	13	0.752	24
Delay by subcontractors	0.653	30	0.811	11	0.775	25	0.746	25
Unskilled equipment operators	0.718	23	0.674	28	0.842	20	0.745	26
Effect of cultural factors on Right of Way acquisition	0.711	23	0.795	14	0.725	26	0.744	27
Discrepancy between design specification and highway code	0.685	29	0.735	25	0.801	24	0.740	28
Delay in instructions from consultants	0.629	31	0.712	27	0.849	19	0.730	29
Unfavourable site conditions	0.774	14	0.614	33	0.683	32	0.690	30
Effect of social factors on Right of Way acquisition	0.742	18	0.818	8	0.501	32	0.687	31
Difficulties in assessing credit	0.621	33	0.727	26	0.692	30	0.680	32
Accidents during construction	0.699	26	0.545	34	0.751	28	0.665	33
Shortage of unskilled labour	0.476	34	0.643	30	0.375	35	0.498	34
Public holidays	0.427	35	0.411	35	0.433	34	0.424	35

6. Discussion

In this paper, the perspectives of clients, consultants and contractors of the 35 causes of delay were analyzed based on the relative importance index. The results are shown in Table 2.

The findings indicate that the ten most important causes of delay in highway projects in Ghana in their descending order are:

- ✓ Delay in honouring payment certificates
- ✓ Equipment failure or breakdown
- ✓ Shortages of materials on site or market
- ✓ Poor site management
- ✓ Late delivery of materials on site
- ✓ Improper construction methods
- ✓ Poor design
- ✓ Foundations conditions encountered on site
- ✓ Underestimation of costs of projects
- ✓ Poor supervision

Delay in honouring payment certificates was ranked highest most important factor for construction delay by all project participants put together. This result agrees with Fugar and Agyakwah-Baah (2010) and Frimpong and Oluwoye (2003), who found out that financial problems are the main factors that cause delay in the construction of building and groundwater projects in Ghana respectively. Since government is the sole client in most road projects in Ghana, all funds needed to execute projects smoothly according to scheduled completion time is dependent on the client's ability to make funds readily available. Failure to pay contractors on time for work done impedes progress and causes delay.

Equipment failure or breakdown was ranked second. Road construction generally is machine intensive and the extensive use of heavy equipment is very common on most projects. Contractors have the option to hire equipment to beef up or support what they already have or lack. Frequent equipment breakdown is very common probably due to lack of planned maintenance and poor cash flow. Many contractors attribute the poor cash flow to the delay honouring of payments by clients.

Shortages of materials are ranked next most important causes of delay in road construction projects. Contractors who are not financially sound find it very difficult to maintain material stock on site. If clients will honour payments on time, contractors' cash flow will be revamped to be able to maintain material stock levels on site.

Clients, Consultants and Contractors together ranked poor site management as the fourth most important factor of delay in road construction projects. Site management involves determining, planning, organizing and controlling the use of resources to achieve the desired results – to achieve the completion of project according to schedule. A poor site management will therefore result in unnecessary delays in responding to issues that arise on site and impacts negatively on the overall work progress. This study revealed that contractors tend to adopt a myopic policy with regard to hiring the requisite and qualified personnel to manage their projects. The few qualified staff they have is made to handle too many jobs concurrently, thereby rendering them ineffective.

The adoption of improper construction methods has negative impact on the project. It is not possible to determine effectively the labour, plant and materials needed in a project until the method of construction is established. Adoption of wrong methods can possibly lead to rework, causing financial lost to contractors.

Poor design was ranked 7th by all respondents. On most projects, contractors complain about the large number of changes required due to design errors, inconsistencies, and incomplete information in the contract documents. This leads to delay and its consequential claims by contractors to recover the cost of delay, inefficiency, and other impacts, resulting from all the changes.

Foundations conditions encountered on site was ranked 8th by clients, consultants and contractors. Unforeseeable conditions and obstructions often refer to matters which are hidden in the ground, such as problematic subsoil, poor quality burrow sources, utility services and the like. The basic rule is that the contractor is only entitled to recompense for any difficulties encountered if it can be established that even an experienced contractor could not reasonably have foreseen what happened. It should be noted that the conditions of contract require tenderers to make all such investigations as are necessary to prepare a realistic tender, including subsoil conditions.

Underestimation of costs of project as a delay was the 9th ranked by all respondents. There is the possibility of having a lowest tender submitted by a contractor who is not suitable for carrying out the works and thereby resulting in waste of time and effort. A contractor having under-priced the works subsequently will look for ways to inflate the price or experience financial difficulties and eventually may not be able to complete the work, hence leading to delay.

Poor supervision was ranked the 10th most important cause of delay by all respondents. Poor supervision leads to shoddy work and consequently reworks which cause delays on most projects. Effective supervision is a vital tool in helping ensure peak performance to complete projects on schedule.

7. Conclusion

This study focused on delay of highway construction projects in Ghana. Based on literature study and interview of project participants – clients, consultants, contractors, 35 causes of delay were identified under ten major groups. The study sought the views of all project participants on the relative importance of the factors that cause delays in highway construction projects in Ghana. This study revealed from the perspectives of respondents that the top ten most significant factors causing delay arranged in descending order of importance are:

- ✓ Delay in honouring payment certificates
- ✓ Equipment failure or breakdown
- ✓ Shortages of materials on site or market
- ✓ Poor site management
- ✓ Late delivery of materials on site
- ✓ Improper construction methods
- ✓ Poor design
- ✓ Foundations conditions encountered on site
- ✓ Underestimation of costs of projects
- ✓ Poor supervision

The results show that clients, consultants, and contractors all agreed that delay in honouring payment certificates was the most significant factor of delay on highway construction projects in Ghana. Equipment failure or breakdown was considered second most important factor, followed by shortages of materials on site and market.

8. Recommended Remedies for Delay

Road construction projects are capital intensive and for that matter there is the need for adequate and timely provision of financial resources for its implementation. Lack of sufficient cash flow affects the construction process negatively. Failure to honour payment to contractors regularly for work done does not only hinders progress and causes delay but also gives rise to irregular payment of wages that often leads to strike actions. Suppliers of materials and services are equally affected.

The following recommendations are made:

- ✓ Clients must ensure that adequate funds are made available before projects are tendered.
- ✓ Payment certificates must be honoured on time to enhance financing of the project.
- ✓ Contract provisions for late payments to the contractor to compensate him in the event of payments being made after the time limit laid down in the contract must be strictly enforced.
- ✓ Both contracting and contractor's team must employ technically competent and qualified staff to manage the project efficiently and effectively. They must also make sure that their staff goes through continual training so that their technical and managerial skills are enhanced.
- ✓ Client must prevail on their consultants to perform thorough constructability review of contract documents prior to the project going out for tender. This ensures that contract documents are adequate before tender and implementation to avoid or minimize the number of changes that need to be made.
- ✓ Consultants must conduct their preliminary site investigations adequately during the design stage to minimize the tendency of the contractor encountering unnecessary unforeseen foundation problems on site. Contract provisions also allow prospective contractors to conduct secondary site investigation at the tendering stage to help build realistic rates to be inserted in the bill of quantities.

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