

# Schedule Delay Analysis of Construction Projects in Ghana: Objectives, Importance and Effects

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## Abstract

The critical observance of time allocation and sequence of operation of construction activities are essential for construction project managers, as delays in construction projects have negative impact on clients and contractors. This study aims at assessing the objectives, importance and effects of schedule delay in construction project execution in Ghanaian construction industries. The research design adopted for this study was descriptive survey using quantitative method. A purposive sampling technique was used to select 80 respondents. Opinion of employees was solicited using a structured questionnaire for data collection. The data was analysed using statistical package for social sciences (SPSS) version 20. The result showed that, major objectives of scheduling in construction projects are to expose and adjust conflicts between trades or subcontractors, to serve as an effective project control tools and to resolve delay claims. The study also revealed that the primary importance of scheduling in construction are to finish projects on time, and to ensure customer satisfaction. Furthermore, it was established that lack of scheduling of construction projects contribute to delays and causes disruptions of construction projects. The study concludes that to ensure timely delivery of construction project, the project objectives, importance of scheduling and effects of scheduling are key factors to consider in order to avoid delays.

**Keywords:** construction project, disruption, project planning, project delay, scheduling

## 1. Introduction

In construction, delays and disruptions are among the challenges faced in executing construction projects. Delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for the delivery of a project (Danso & Antwi, 2012). It is a project slipping over its planned schedule, and this is a common problem in construction projects. In some cases, delay causes higher overhead costs to the contractor because of longer work period, higher material costs through inflation, and due to labour cost increases. Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. The sources are the performance of parties, resources availability, environmental conditions, involvement of other parties, contractual relations, and completion of a project within the specified time is rare (Assaf, 2006). When projects are delayed, they are either extended or accelerated and therefore, incur additional cost. The normal practices usually allow a percentage of the project cost as a contingency allowance in the contract price and this allowance is usually based on judgment (Akinsola, 1996). Although the contract parties agree upon the extra time and cost associated with delay, in many cases there are problems between the owner and contractor as to whether the contractor is entitled to claim the extra cost. Such situations result in questioning facts, causal factors and contract interpretations (Alkass, *et al.*, 1996).

Construction schedule delays in projects can cause major problems for contractors and owners, resulting in costly disputes and other controversial issues. Schedule delays commonly occur in construction projects and often result in delay claims. However, there is no well recognized and acceptable claim resolution approach for solving construction schedule delays. Several studies have proposed different schedule delay analysis methodologies for performing delay analysis systematically. The common used methodologies include global impact, net impact, adjusted as-built CPM, as-planned expanded, but-for, snapshot, time impact, windows, isolated delay type techniques and isolated collapsed but-for delay analysis methodologies (Ng, *et al.*, 2004; Mohan and Al-Gahtani, 2006; Yang & Yin, 2009). All these methods of schedule delay analysis have their pros and cons. This study assesses the objective; importance and effect of using schedule delay analysis in construction projects execution in Ghana. The objectives of the study are (1) to determine the objectives of scheduling in construction projects, (2) to determine the importance of scheduling in construction projects and (3) to determine the effect of lack of scheduling in construction project.

## 2. Literature review

### 2.1 Project scheduling

The terms (project planning and project scheduling) are often mistakenly thought of as synonymous. However, as Mubarak (2005) indicates, scheduling concentrates on the timing and sequence of operations in the project planning effort. Therefore, while project planning covers the issues of what is going to be done? where? how? and when? the term project scheduling, covers only the issue of when? Trauner, *et al.* (2009) agree with Mubarak and define project schedule as “a written or graphical representation of the contractor’s plan for completing a construction project that emphasizes the elements of time and sequence”. According to the Trauner, *et al.* (2009), the project schedule should display all the construction tasks from the beginning of the project through completion, the time periods for each tasks, and the sequence of these tasks in a logical order. Oxley and Poskitt (1996) define project scheduling as “the process of determining the actual time periods during which the activities are planned to take place: that is, start and finish dates for each activity”. In order to determine the construction activities and their time periods, project planning should be done before project scheduling. Oberlender (2000) claims that a successful project planning is more difficult to organize than scheduling. If the activities are identified in project planning, then scheduling the project will become relatively easy.

### 2.2 The objectives of project scheduling

After a successful planning process, the schedule of the project is prepared based on the project objectives. There are major objectives that are expected from good project scheduling. According to Mubarak (2005) there are eight important objectives of scheduling, these are: to calculate the project completion date, to calculate the start or end of a specific activity, to expose and adjust conflicts between trades or subcontractors, to predict and calculate the cash flow, to evaluate the effect of changes, to improve work efficiency, to resolve delay claims, and to serve as an effective project control tool.

A project schedule is viewed as a valuable project control tool for project managers to successfully conduct construction projects (Trauner, *et al.*, 2009). Trauner, *et al.* (2009) further explain the basic objectives of a project schedule as effectively depicting the construction plan to the project participants, permitting management to control and measure the progression of the work, and finally provide the participants with information for timely decisions.

Callahan, *et al.* (1992) claim that the probabilities of on-time, on-budget, and dispute free completion may be increased by means of a schedule and the objective of the schedule as specified by the individual using the schedule. The authors further explain that the objectives of predicting project completion for contractors is that they can arrange crew sizes and equipment to speed or slow progress. For architects or engineers, the objective is to determine how long the design and construction will take for completion of the project.

### 2.3 Delays

Delay is a major problem in construction industry. The word “delay” in construction, refers to something happening at a later time than planned, expected, specified in a contract or beyond the date that the parties agreed upon for the delivery of a project (Pickavance, 2005). Trauner, *et al.* (2009) defines construction delays as something that happens later than expected, to cause something to be performed later than planned, or not to act timely. Assaf and Al-Hejji. (2006) further illustrate that, to the building owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. To the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and increased labour cost.

Syed, *et al.* (2002) classify delays into non-excusable delays, excusable non-compensable delays, excusable compensable delays and concurrent delays. Non-excusable delays are delays, which the contractor either causes or assumes the risk. Excusable non-compensable delays are delays caused by factors that are not foreseeable, beyond the contractor’s reasonable control and not attributable to the contractor’s fault or negligence. Compensable excusable delays are compensable delays that are excusable, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the owner resulting from owner’s breach of an obligation, stated or implied, in the contract. Concurrent delays occur when both owner and the contractor are responsible for the delay.

Factors which cause delay in the construction projects also have some effects on the overall project (Finke, 1999). When there is delay in construction projects, they are either expedited or the scheduled time for the completion of project is extended. The result is cost overrun in both the cases. Main reason of cost overrun in the construction projects are the delays in the delivery of materials to the project sites in the developing countries (Manavazhi & Adhikari, 2002). Other major factors which are responsible for time overrun in the construction projects are revision and approving of design documents, delay in getting approval for major changes during the project, delay in sub-contractor work and the conflicts in sub-contractor schedule work and the conflicts in sub-contractor schedule in project execution (Wei, 2010).

## 2.4 Disruptions

Disruptions are events that disturb the construction programme. Interferences with the flow of work in the project are common disruptions (Howick, *et al.*, 2009). Howick, *et al.* (2009) point out that many disruptions to complex projects are planned for at the bid stage because they may be expected to unfold during the project. For example, some level of rework is usually expected, even when everything goes well, because there will always be 'normal' errors and mistakes made by both the contractor and client (Howick, *et al.*, 2009).

## 2.5 Causes of construction delays

Abd El-Razek, *et al.* (2008) studied several articles on examining the causes of construction delays in many ways; some studies determined the main causes of delay in different countries, while some of them investigated the delay analysis methods in different types of construction. Assaf, *et al.* (1995) studied the main causes of delay in large building projects in Saudi Arabia and their relative importance. In the study undertaken by Assaf, *et al.* (1995), the largest number of causes of delay (56 causes) was listed and the respondents were asked to point out their degree of importance. The authors grouped the delay factors into nine major groups: financing, materials, contractual relationships, project changes, government relations, manpower, scheduling and control, equipment, and environmental factors. The financing group of delay factors was selected as the most significant delay factor by all parties and that environment group was selected as least significant. In another observation, Odeh and Battaineh (2002) carried out a study to determine the most significant causes of construction delays with traditional type of contracts with regard to contractors and consultants. According to the results of the study, owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most significant causes of delays.

Wahdan, *et al.* (2013) carried out a study to assess the reasons for project delay or stalled from project management view in most of Arab countries. Based on the opinions provided by the respondents, specialists, associations and institutes involved in the construction sector, as well as prior studies conducted by previous researches, the researchers prepared a comprehensive file on preventative measures and recommendations, guided by strict criteria, which helped clarify the problems for the causes of construction projects delay. Their ranking method for the collected data captured ten major causes for project delay. The major ten causes, according to Wahdan, *et al.* (2013) ranking from the highest to the lowest are: inadequate details; inadequate design; difficulties in obtaining licenses, permits from authorities; deficient in planning activity, material, labour and equipment management; shortage of skilled labourers; delays in preparation of technical documentation by project designers while construction is in progress; neglect of critical activities; frequent change orders during construction; deficient coordination among participants; low productivity and delay in the drafting and submitting of requests for institutional opinions and authorizations.

Danso and Antwi (2012) evaluate the factors influencing time and cost overruns of the telecom tower construction projects in Ghana. They found 15 major factors influencing time overruns and 14 major factors causing cost overruns in telecom tower construction projects in Ghana. Danso and Antwi (2012) 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%.

## 3.0 Methodology

This study adopted a quantitative research approach, which is the numerical representation and manipulation of observations for the purpose of describing and explaining the phenomenon that those observations reflect (Babbie, 2005). This made use of descriptive survey that allowed the collection of quantitative data and also enabled the use of quantitative methods in the analysis of data.

The study population comprised of 15 construction companies targeted from Ashanti, Brong- Ahafo and Eastern regions of Ghana. Site managers, site supervisors and site engineers constituted the population of the study because they are knowledgeable in their areas of expertise. Purposive sampling was used to select eighty (80) employees from the various companies working on the construction site. In Ashanti region, seven construction companies were selected with five (5) employees from each of the companies, totaling 35 respondents. In Brong-Ahafo region, five (5) construction companies were selected with five (5) employees from each of the five companies, totaling 25 respondents. Whiles in Eastern region, three (3) construction companies were selected with six, eight, and six employees from the three companies respectively, totaling 20 respondents. According to De Looft (1996), a sample size of more than 10% of the population is enough for a credible empirical study.

The instrument used for data collection was questionnaires. The questionnaire was distributed to the 80 employees, out of which 70 were returned. This gives response rate of 87.5%. Five point Likert scale was used. These were: strongly disagree (1), disagree (2), uncertain (3), agree (4), and strongly agree (5). The validity of the study was achieved by ensuring that the questionnaires reflect the content of the literature review and correction of ambiguous items. Cronbach's coefficient alpha reliability values were calculated to assess the

degree to which the items that make up the scales are all measuring the same underlying attribute. Nunally and Bernstein (1994) recommends a value of 0.60 considered as the lower limit of acceptability for Cronbach’s alpha, however, values above 0.8 are preferable. The test for reliability of the study revealed that the Likert scale items obtained a Cronbach’s reliability alpha value of 0.899, which is more than the limit of acceptability (0.60). Statistical tool used for data analysis was statistical package for social sciences (SPSS), version 20.

#### 4.0 Result

##### 4.1 The objectives of project scheduling

This part of the study examined the objectives of scheduling in construction projects. The respondents were asked to indicate their level of agreement or disagreement on underlying statements measuring the objectives of scheduling in construction projects on a five point Likert scale. The hypothesized mean value of 4.500 or above was adopted as the major objective of scheduling in construction projects. The results obtained are presented in Table 1.

**Table 1: Descriptive statistics on objectives of scheduling in construction projects (n=70)**

Statement	Mean	Std. Dev.	Rank
To expose and adjust conflicts between trades or subcontractors	4.775*	.42022	1 <sup>st</sup>
To serve as an effective project control tool	4.763*	.42824	2 <sup>nd</sup>
To resolve delay claims`	4.675*	.47133	3 <sup>rd</sup>
To evaluate the effect of changes	4.400	.49299	4 <sup>th</sup>
To improve work efficiency	4.313	.46644	5 <sup>th</sup>
To predict and calculate the cash flow	4.175	.38236	6 <sup>th</sup>
To calculate the start or end of a specific activity	4.137	.34655	7 <sup>th</sup>
To calculate the project completion date	4.063	.24313	8 <sup>th</sup>

\* Indicates hypothesized mean value ( $\geq 4.5$ )

As can be noted from the results, there are three major objectives of scheduling in construction projects since all the three variables had their mean values above the hypothesized mean value of 4.500. The three items include “to expose and adjust conflicts between trades or subcontractors (M=4.775; SD=0.42022)”, “to serve as an effective project control tools (M=4.763; SD=0.42824)” and “to resolve delay claims (M=4.675; SD=0.47133)”. This finding is in line with the finding of Mubarak (2005) who identified eight important objectives of scheduling as to calculate the project completion date, to calculate the start or end of a specific activity, to expose and adjust conflicts between trades or subcontractors, to predict and calculate the cash flow, to evaluate the effect of changes, to improve work efficiency, to resolve delay claims, and to serve as an effective project control tool. As noted by Razaque *et al.* (2012), the objectives of project scheduling approach are to focus on critical chain schedule and risk management. In reality, based on project, the critical approach is always changed critic to promote progress of project, and the project manager has to predict project future time.

##### 4.2 The importance of project scheduling

This part of the study sort to explore the important of project schedule in relation to project management scheduling in construction industry in Ghana. The respondents were asked to indicate their level of agreement or disagreement on underlying statements measuring the importance of scheduling in construction projects on a five point Likert scale. The hypothesized mean value of 4.500 or above was considered as the most important of project schedule. The results obtained are presented in Table 2.

**Table 2: Descriptive statistics on the importance of scheduling to construction projects (n=70)**

Statement	Mean	Std. Dev.	Rank
To finish project on time	4.625*	.48718	1 <sup>st</sup>
To ensure customer satisfaction	4.513*	.50300	2 <sup>nd</sup>
To finish project within budget	4.250	.43574	3 <sup>rd</sup>

\* Indicates hypothesized mean value ( $\geq 4.5$ )

The results show how respondents rank individual variables as its contribution to the importance of scheduling. To finish projects on time was ranked first (1<sup>st</sup>) position followed by to ensure customer satisfaction was ranked second (2<sup>nd</sup>) position. To finish project within budget was ranked third (3<sup>rd</sup>) position. However, the respondents rated ‘to finish projects on time’ and ‘to ensure customer satisfaction’ as the most important scheduling to construction projects, with their mean values above the hypothesized mean value of 4.500. This finding implies that finishing project on time and ensuring customer satisfaction were the major factors contributing to importance of construction project scheduling. This is consistent with Callahan *et al.* (1992) that the objective of project schedule is to predict project completion for contractors so that they can arrange crew sizes, shifts and equipment to speed or slow progress. It is important for the construction companies to clearly define the need to emphasis on project scheduling in order to yield a better performance in construction projects.

### 4.3 The effect of lack of scheduling to construction projects

This part of the study explores the effect of lack of scheduling on construction project execution in Ghana. The results are presented in Table 3 below. All variables were measured using a five point Likert scale. The hypothesized mean value of 4.500 or above was considered as the most effects of lack of scheduling to construction projects.

Table 3: Perception on the effects of lack of scheduling to construction projects (n=70)

Statement	Mean	Std. Dev.	Rank
Delays	4.750*	.43574	1 <sup>st</sup>
Disruptions	4.500*	.50315	2 <sup>nd</sup>
Cost and schedule overruns	4.275	.44933	3 <sup>rd</sup>

\* Indicates hypothesized mean value ( $\geq 4.5$ )

The results show that the major effects of lack of scheduling to construction projects are delays and disruptions. Delays in construction projects was ranked first (1<sup>st</sup>), followed by disruptions of construction projects which was ranked second (2<sup>nd</sup>). This finding has many similarities with Danso and Antwi (2012) study on evaluation of the factors influencing time and cost overruns of the telecom tower construction projects in Ghana. Their study found fifteen (15) major factors influencing time and cost overruns in telecom tower construction in Ghana. Some of the factors are payment certificates, delays in design work and design information and contract modifications, poor workmanship leading to rework, poor site management. Another study which agrees with the findings by Howick, *et al.* (2009) point out that many disruptions to complex projects are planned for at the bid stage because they may be expected to unfold during the project. Some level of rework is usually expected, even when everything goes well, because there will always be 'normal' errors and mistakes made by both the contractor and client (Howick, *et al.*, 2009). This depicts the relevance of project scheduling to the construction companies in Ghana.

### 5.0 Findings and Conclusion

Project planning in construction project has been successfully undertaken across generations due to schedule that concentrates on proper timing and sequence of operations in the work allocations. From the results, the study found that the major objectives of scheduling in construction projects include exposing and adjusting conflicts between trades or subcontractors, to serve as an effective project control tool, and to resolve delay claims. The major importance of scheduling in construction projects that were found are to finish projects on time and to ensure customer satisfaction. The study also found that the major effects of lack of scheduling in construction projects are delays and disruptions of construction projects. It is therefore concluded that to ensure timely delivery of construction project, the project objectives, importance of scheduling and effects of scheduling are key factors to consider in order to avoid delays.

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