Causes of delays in construction industry

[1]Girirajsinh G Rathod, [2]Kuldeep Yadav, [3]Alert Darshan

Student,
Department of Construction Management,
MIT College of Management, Pune, India

***Abstract*: The purpose of this paper is to reveal the main causes of delays in the projects are from the client (relative importance index (RII)=0.716), labor and equipment (RII=0.701) and contractor (RII=0.698). Hence determining the contractual responsibility of delay is the most likely source of dispute in construction projects and many techniques have been used in the courts to demonstrate the criticalities of a delay event on the project schedule. Therefore, authors try to investigate all process-based techniques of delay claims and evaluated and conformed them with principles by Society of Construction Law (SCL) protocol and Association for the Advancement of Cost Engineering International (AACEI) in order to choose the best techniques based on the specific circumstances of each project.**

***Keywords*: AACEI, SCL, DELAY.**

1. INTRODUCTION

In construction, 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 delivery of a project. To the owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Therefore, 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 and it is necessary that a detailed assessment be conducted and calculates the loss resulted from delays on both parties in the projects with time required for the extension of projects time if the project is delayed .A lot of research efforts have been made to study delay causes in different countries. For example, Odeh and Battaineh (2002), Vilventhan and Kalidindi (2016) showed In construction, 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 delivery of a project. To the owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Therefore, 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 and it is necessary that a detailed assessment be conducted and calculates the loss resulted from delays on both parties in the projects with time required for the extension of projects time if the project is delayed. A lot of research efforts have been made to study delay causes in different countries. For example, Odeh and Battaineh (2002), Vilventhan and Kalidindi (2016) showed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and sub-contractors are among ten top most important factors causing delay in Jordan; Maura et al. (2007) discovered that design errors, client liability, project specification and direct change order by the client are the major factors that cause the time and cost overrun in Portuguese; Abdul-Rahman et al. (2006) conducted a study on delay mitigation in the Malaysian construction industry; they proved that a financial problem is confirmed by the survey as the main causes of delay. Hence, one of the most important problems in the construction industry is delay and it is essential to define the actual causes of delay in any construction project. So choosing an appropriate delay analysis method is an important part of construction industry. The famous process-based methods include the global impact, net impact, adjusted as-built CPM, as-planned expanded, but-for, snapshot, time impact, windows and isolated delay type techniques (Yang et al., 2006; Yang and Kao, 2007). These techniques are applied to prepare the logical basis to persuade their claims concerning the extension of time and financial burden but each delay analysis method adopts a different approach to identify delay impacts and may yield different results. But in Iran, there is not a comprehensive and practical package for delays analysis techniques to determine which one is appropriate in accordance with the feature of the project. So the authors examine all delay analysis techniques that are frequently used in the construction project in Iran in order to determine which delay analysis techniques is appropriate for each construction project. In this paper the main causes of delays in Iranian construction projects have been determined and the aim of this study is to operate a method based on which one could select the delay analysis techniques appropriate to the nature of the projects that what is needed to implement this method is to analyze the Society of Construction Law (SCL) protocols and analytical delay techniques and then to implement standards of protocol with delay analysis techniques. that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and sub-contractors are among ten top most important factors causing delay in Jordan; Maura et al. (2007) discovered that design errors, client liability, project specification and direct change order by the client are the major factors that cause the time and cost overrun.

2. Overview

In total, 78 causes of delay were identified through research. The identified causes are combined into seven groups. The field survey included 58 contractors, 55 consultants, and 62 client. Data collected were analyzed by RII and Statistical Package for Social Sciences (SPSS). The authors identified main causes of delay and ten most important causes, according to Table AII, from the perspective of three major groups of participants (clients, consultants and contractors). The ranking of categories of causes of delay, according to Table I, were: client-related causes (RII=0.716); labor and equipment category causes (RII=0.701); contractor-related causes (RII=0.698); material-related causes (RII=0.690); design-related causes (RII=0.666); external causes (RII=0.662); and consultant-related causes (RII=0.662). But according to the discussions and given that determining the contractual responsibility of delay is the most likely source of dispute in construction industry and many techniques have been used in the courts to demonstrate the criticalities of a delay event on the project schedule.

3. Literature review

Many researchers have studied the causes of delay and delay analysis techniques in the construction industry. We have broken the studies into two parts: studies on causes of delay; and studies on delay analysis techniques.

Delay in construction is a global phenomenon affecting not only the construction industry but the overall economy of countries as well (Sambasvian and Soon, 2007; Parchamijalal and Shahsavand, 2016). Delays in construction are caused by several factors. Ahmed et al. (2003) grouped delays into two categories – internal causes and external causes. Internal causes arise from the parties to the contract (e.g. contractor, client, and consultant). External causes, on the other hand, arise from events beyond the control of the parties. These include the act of God, government action, and material suppliers. Sweis et al. (2008) studied 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. Abd El-Razek et al. (2008) in a similar study in Egypt found that the most important causes of delay are financed by contractor during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction, and non-utilization of professional construction/contractual management. Sambasvian and Soon (2007) identified the delay factors and their impact on project completion in the Malaysian construction industry. The results indicated that the ten from a list of 28 different causes of delay were: contractor's improper planning; contractor's poor site management; inadequate contractor experience; client's inadequate financial resources and payments for completed work; problems with subcontractors; shortage in material; labor supply; equipment availability and failure; lack of communication between parties; and mistakes during the construction stage conducted a survey on time performance of large construction projects in Saudi Arabia. The survey had 73 different causes of delay. He studied the importance of various causes from the viewpoint of contractors, consultants, and owners. The most common cause of delay identified by all the parties was "change order." He also found that about 70 percent of the projects experienced time overruns.

The previously mentioned studies were generally focused on finding causes of delays. Some of these studies identified very limited (lacking) factors or ignored some important groups. This may be misleading or may result in wrong analysis. In this paper, through a comprehensive literature review and interviews with highly experienced construction professionals, the authors attempted to use the relative importance index (RII) method in the quantification of the relative importance of a comprehensive list of delay factors in construction projects in Iran.

4. Methodology

This section is divided into two distinct parts: refers to the methods used to assess the perceptions of clients, consultants, and contractors on the relative importance of causes of delay in construction industry; and refers to the nature of process-based techniques used to analyze delays and their conformity with SCL protocol. **Experts' perception of causes of delay**

A questionnaire was developed to assess the perceptions of those in the Iranian construction industry on the relative importance of causes of delays. Then the questionnaire was filled out by highly experienced construction professionals including project managers, site managers, technical office managers, technical office engineers, procurement managers, and technical consultants. The collected data were analyzed through the RII method. RII or weight is a type of relative importance analyses. RII was used for the analysis because it best fits the purpose of this study. The analysis included ranking the different causes according to the relative importance indices. The analysis revealed the factors and groups that contribute most to delays.

The respondents were asked to indicate their response category on 78 well-recognized Construction delay factors identified by authors. These causes were categorized into the following seven major groups. Client-related causes (with 19 factors); contractor-related causes (with 13 factors); consultant-related causes (with 9 factors); design-related causes (with 8 factors); material-related causes (with 8 factors); labor and equipment category causes (with 8 factors); and external causes (with 13 factors). A five-point Likert scale ranging from 1 (very low) to 5 (very high) was adopted to capture the importance of causes of delays. Before distributing the questionnaires, a small interview with industry professionals was conducted that includes 15 clients, 15 consultants and 15contractors. The basic purpose of this interview was to verify the completeness of the questionnaire in capturing the factors relevant for Iran. All the respondents agreed that the questionnaire was sufficient to capture the causes of delays. We distributed the questionnaires through our co-workers in Public Works Department of Iran, developers, consultants and construction firms. Our co-workers in turn distributed to their friends. This sampling method enabled us to obtain a large number of completed questionnaires quickly and economically. In total, 250 sets of questionnaires were distributed to the potential respondents at all levels in the organizations within the construction industry. In all, 100 sets were distributed to clients, 70 sets to consultants and 80

sets to the contractors. Of the 250 questionnaires, 175 sets (70 percent) were returned and there were 62 sets (62 percent) from clients, 55 sets (79 percent) from consultants and 58 sets (73 percent) from contractors.

5. The Nature of process-based techniques

All process-based techniques of delay analysis have been present in this paper and categorized in 11 groups. In order to understand the pros and cons of them, a thorough review conducted with the participation of clients, contractor and consultant to reveal the nature of these techniques. The results of this review on techniques have been obtained based on several years' experiences of the client, consultant and contractor and studies that have been done by authors .In the next step, the most appropriate technique has been selected based on constraints and specific conditions of each project, which is one of the most important steps to carry out a successful delay analysis. The authors conformed, all process-based techniques of delay analysis, by SCL protocol and Association for the Advancement of Cost Engineering International (AACEI) principles. The SCL protocol recommends that wherever possible, an appropriate method should be agreed and adopted by the parties before retrospective delay analysis is carried out. The protocol gives guidance on the appropriateness, or otherwise of different types of retrospective delay analysis to different evidential situations. The protocol suggests that if the method is not agreed between the parties, then this failure to agreement should be taken into consideration by the arbitrator, or judge when awarding the costs of the dispute. Finally, the result of this match was brought in order to choose the best technique based on the specific circumstances of each project.

Conclusion

1. Construction projects often suffer from delays due to a wide variety of reasons, which can have severe financial impact on the project. As a result, delay claims may be filed. But delays can be avoided or minimized when their causes are clearly identified. However, in case of delays the analysis of its impact, the causes, and effects of the delaying activities is one of the most complicated types of claims analysis. The aim of this paper is to identify the delay factors in construction projects and introduction type of delay analysis techniques for applying more reliable and precise techniques in order to reduce the frequency and to mitigate the severity of disputes and litigation due to delay claims because delays are considered to be a serious problem in the construction industry.

Hence through a detailed literature review and interviews with experts from the Iranian construction industry, a total of 78 different delay factors were identified and categorized into seven groups the field survey included 58 contractors, 55 consultants and 62 clients. Data collected were analyzed by RII and SPSS. We identified main causes of delay and ten most important causes, according to

2. According to the discussions and given that determining the contractual responsibility of delay is the most likely source of dispute in construction industry and many techniques have been used in the courts to demonstrate the criticalities of a delay event on the project schedule, the authors discussed the pros and cons of all process-based techniques of delay claims and compared the versatility of each of them with SCL protocol in order to choose the best techniques based on the specific circumstances of each project.

3. The Iranian projects have been classified from magnitude perspective into three categories and from the perspective of emergence of delays; they have divided into six groups. Several methods of analyzing delays have been compared from different dimension. So regarding the features of projects one could select the most suitable methods kind based on. For example, for those mega projects with many delays, i.e. 6th class, the methods of analysis of delays has been selected as the most suitable method.

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