A STUDY ON THE PRACTISE OF DELAY ANALYSIS TECHNIQUES IN THE MALAYSIAN CONSTRUCTION INDUSTRY

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ABSTRACT

Professional practice underlines the application of the right techniques to assess delays in the determination of extension of time (EOT) in construction projects to ensure fair judgement. However, in the Malaysian construction industry the numbers of dispute cases relating to EOTs are high. Critics are frequent in arguing that there are inadequacies in the way this is being practised.

This paper presents the research study which investigates the validity of this argument. A quantitative research method was adopted by drawing the views from the key professionals involved in assessing delays in construction projects. The findings suggest that, in the main, the application of the right delay analysis techniques within the industry need to improve. The general low level of knowledge amongst some of them on the concepts of critical path method (CPM) and its significance in determining the validity of EOTs significantly contribute to this. Initiatives to promote the appreciation of the right delay assessment techniques in extension of time (EOT) need to be considered to address is weakness.

Keywords: Extension of time (EOT), delay, critical path method (CPM), delay analysis techniques

1. INTRODUCTION

The construction industry requires an effective and reliable method of analysing delays, but the method of analysis in common use are frequently inadequate to account for several commonly encountered situations (*Kim et al*, 2005). As a result, project time extensions are often considered without rigorous analysis. Knowles (2007) identify that EOT claims in construction contracts were normally assessed by Contract Administrators on an imprecise basis without much detailed analytical reasoning. This was usually after the contractor had submitted little more than a basic list of events that had caused the delay and disruption, claiming a ‘gross’ EOT usually without reference to the cause and effect of each individual delay event.

It is imperative that the right delay analysis techniques must be adopted to correctly assess EOT applications. Underpinning this is the selection and application of the right project planning tool supported with tangible data that can accurately reflect the validity of the claims. This necessitates sound understanding of how delays are calculated, and the implications of the use of the right techniques when administering claims relating to delays in EOT (Oliveros and Fayek, 2005).

The Malaysian construction industry is continually confronted with issues of claims on delays in deciding EOT. Kadir *et al* (2005) point out that among the most significant contributing factor to inaccurate delay evaluations are poor knowledge and inexperience amongst the project management people. Thus, contractors are often unable to provide good justifications to support their EOT applications. Similar lack of knowledge among the consultants and client’s representative tends to lead to disputable judgements in EOT which can end up in disputes.

The extent of the application of the right delay analysis techniques amongst the key parties responsible for managing delays in the Malaysian construction industry was investigated, and this paper presents the research. The aim was to investigate the practise of delay analysis techniques adopted when evaluating EOTs. The research theoretical framework is first presented, followed by the methodology, data collections and analyses. The findings which suggest the relatively average level of application of the right techniques for assessing delay in EOTs are discussed. The way forward to address this problem is suggested at the end of the paper.

2. RESEARCH METHOD

2.1 The Conceptual Framework

The research conceptual framework was developed by drawing data from books, research reports, academic papers and journals. The themes drawn culminated to contextualise the research are as follows:

Context of delays: Project Planning, Monitoring and Control

Loke (2007**)** suggested that project planning for 'time' is the process to quantify the amount of time a project will take. This is done to create a project plan which the manager can use to track progress of his team on a project. He adds that monitoring and controlling consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken. The key benefit is that, project performance is observed and measured regularly to identify variances from the original project management plan.

In stressing the importance of effective monitoring and control, Philips (2004) observes that effective project time monitoring and control necessitates the measurement of the ongoing project activities (*where we are*); monitoring the project actual time schedule against the project plan or the project performance baseline (*where we should be*); identify corrective actions to properly address issues and risks (*how can we get on track again*); and influencing the factors that could circumvent integrated change control so only approved changes are implemented. Lewis (2006) suggests that in multi-phase projects, the monitoring and controlling process also provides feedback between project phases to implement corrective or preventive actions to bring the project into compliance with the project management plan.

Delay

Delay is an act or event that extends the time required to perform task under a contract Stumpf (2000). Zack Jr. (2000) views delay as an effect to the end date of the project or effect to the project's critical path. Delay is generally acknowledged as the most common, costly, complex and risky problem encountered in construction projects Alaghbari *et al (*2007). Delays can occur in any construction project and the magnitude of delay can varies considerably from project to project. Pre-identification of the causes of delay can minimise its impact.

Delay Analysis Techniques

In assessing delays, a number of approaches have come into being. The most commonly applied are:

i. 'What-if' / As-Planned Impacted Analysis

A common method to classify delay assessment technique known as the *'What-if' / As-Planned Impacted Analysis* was drawn from Stumpf (2000) and Lovejoy (2004). This technique is also commonly known as the 'impact as-planned' (baseline) method, part of the 'forward approach' technique (Baram, 2000) or Veterans Administration Method (Popescu-Kohler, 1998). This method uses the baseline (as-planned) schedule as the basis. To assess delays, the contractor's delayed activities are added to the baseline schedule to calculate the total delay attributable to the contractor. To assess the effect of client-caused delay, his delay activities are added to the baseline schedules to demonstrate the total delay attributable to the clients.

ii. The 'But-For' Technique

Known in Knowles (2007) as 'as-built collapse' analysis technique, or the 'backward approach' in Baram (2000) and Popescu-Kohler (1998), this method uses the as-built schedule / programme. The analysis starts from the end of the project and moves backward toward the beginning of the project using mainly the as-built information. The as-built information can take the shape of an as-built schedule, which is supposed to reflect the actual sequence and duration of the tasks described.

iii. 'Window' Analysis

The window analysis is the most highly rated method of analysis. It is most recognised in construction industries and popular with legal practitioners (Ciccarelli and Cohen, 2005) because it considers the dynamic nature of the critical path (Lovejoy, 2004). Window analysis method focuses on the delay the moment they impact the critical path of the schedule, utilising the then existing project critical path thereby allowing the user to accurately clarify delay. The analysis starts from the beginning of the project and continues forward toward to the end of the project using available data and schedule. This technique is also identified as part of the 'forward approach' technique (Baram, 2000b and Popescu-Kohler, 1998).

iv. The As-Planned (Baseline) vs. As-Built Comparison Method

The as-planned (baseline) vs. as-built comparison method compares the baseline schedule to the as-built schedule. The baseline schedule represent the contractors' original plan for completing the works required by the contract documents, with- in the time frames establish by them. It includes planned activities, their duration and relationship and any completion dates imposed by the contract documents. This method is also known as the 'total time approach' by Stumpf (2000) and perhaps the oldest and straightforward technique of delay analysis (Lovejoy, 2004).
The features of the four delay analysis techniques discussed are summarised in Figure 1.

'What-if' / As-Planned Impacted Analysis	**The 'But-for' Analysis**
▪ Use CPM networks to demonstrate delay impacts. ▪ Baseline (as-planned) schedule as basis. ▪ Start from the beginning of the project. ▪ Continues forward toward the end of the project using the available data and schedule.	▪ Uses the as-built schedule / programme as basis. ▪ Analysis starts from the end of the project and moves backward toward the beginning of the project. ▪ The as-built information reflects the actual sequence and duration of the tasks described.
'Window' Analysis.	**The As-Planned (Baseline) vs. As-Built Comparison Method**
▪ Focuses on the delay the moment they influence the critical path of the schedule. ▪ Analysis starts from the beginning of the project. ▪ Forward move to the end of the project using available data and schedules. ▪ Breaks the construction period into discrete time period and examines delay when they occurred. ▪ Assesses the schedules on one reporting period. Sometime - updates schedule before and after the delay date to see the changes of critical path.	▪ As-planned and as-built schedules as the basic sources for delay analysis. ▪ Compares the baseline schedule to the as-built schedule. ▪ The as-built schedule portrays the actual sequence of activity as they occurred during the project. ▪ The as-built schedule shows the actual start and finish of each activity, including activity disruption and discontinuity. ▪ Activities added to the baseline schedule, as well as planned changes should be shown.

Figure 1: Features of the Delay Analysis Techniques

2.2 The Research Methodology

A Quantitative research method was adopted. Selected random sampling of respondents representing clients, consultants and contractors in the administration of the delay assessments were chosen as the survey respondents. The research main questions were:

- What are the extents of delays?

- How frequent are project plans updated?
- What methods are used to determine the critical path? and,
- What are the techniques used to assess delays?

Following the pilot research process, an on-line questionnaire survey was administered. The respondents, with an average of 10 years experience in managing construction projects, participated in the survey. For the purpose of the analysis they were divided into four groups of respondent i.e.; (i) consultant architects, (ii) consultant civil and structural engineers, (iii) consultant quantity surveyors, and (iv) project managers, construction managers or project engineers employed by contractors.

A total of 291 questionnaires were sent out. 107 or 37% of the respondents completed and returned the questionnaires. The breakdown of the respondents is shown in Table 1.

Response Data	**Number of Questionnaires**		**Percentage**
	Sent	**Respond**	**Respond (%)**
Architects (with architect firms)	72	25	35%
Civil Engineers (with consulting engineer firms)	64	29	45%
Quantity Surveyor (with QS consulting firms)	60	22	37%
Project Manager / Construction Manager / Planning Engineer / Contract Manager / Quantity Surveyor (with contractors)	95	31	33%
TOTAL	**291**	**107**	**37%**

Table 1: The Survey Respondents

Descriptive statistics were used to analyse the data and the findings emerged as follows.

3. RESULT FROM THE ANALYSIS

3.1 Extents of Project Delays

87% of the respondent reported that they have encountered delays in their projects. 10% of the respondents have delays in all their projects, 23.5% of the respondents have more than half of their projects delayed, and 35% of the respondents experienced about 1/3 of their projects delayed.

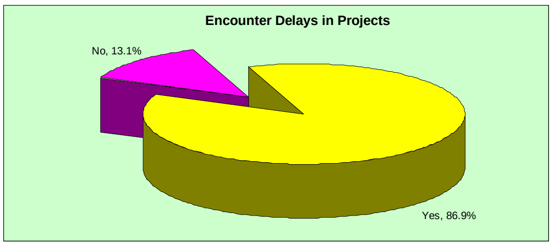


Figure 1: Experiences in Encountering Delay

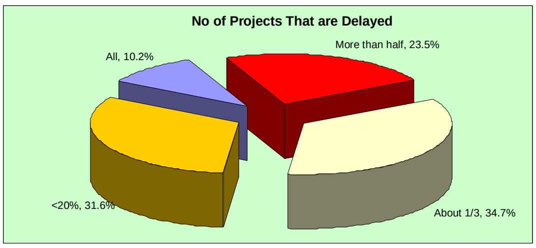


Figure 2: Projects Suffers Delayed

3% of the respondents reported that their projects suffered delay by more than 40%, 38% of the respondents reported that their projects were delayed by between 20% - 40%, while 29% of respondent reported that their projects only suffers delay by less than 20% (Figure 2).

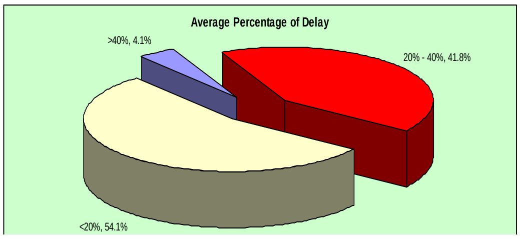


Figure 3: Average Percentage of Delay

Concurrent with Sambasivan and Soon (2007) who observes that delay in Malaysian construction project is a common phenomenon, this suggest that the problem is continuing.

3.2 The Methods Used to Determine the Project Critical Path

The application of CPM to monitor and control the project progress was next investigated. In contrast to Galloway (2006) who observes that the Primavera Project Planner is the most popular project planning, monitoring and control software in the United States of America (Figure 4), Microsoft Project software emerged to be the most popular software used in Malaysia. The baseline schedule is the most popular CPM used, 70% of the respondents use the CPM to monitor the project progress on site while 17% of respondents do not use any form of CPM in the project monitoring and control progress (see Figure 5 and 6).

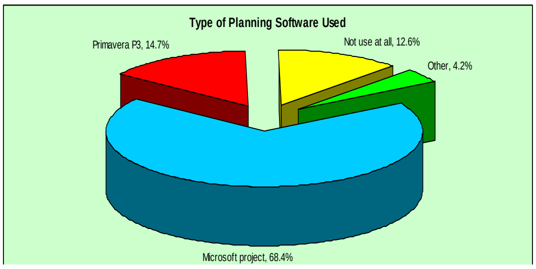


Figure 4: Type of Planning Software Used

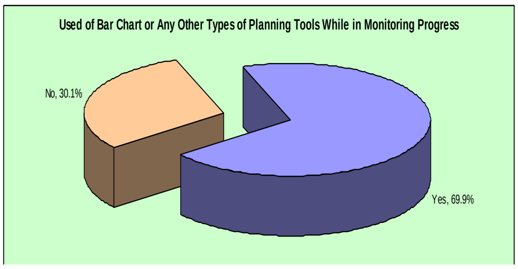


Figure 5: Used CPM in Monitoring Projects?

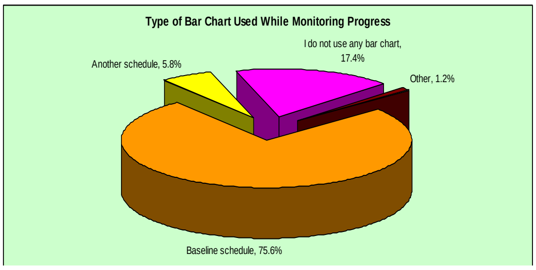


Figure 6: Type of CPM Used While Monitoring Progress

3.3 Frequency of Updating the Work Programme

The Critical Path and the Milestone emerge to be the most common techniques used when assessing the baseline CPM (see Figure 7). The use of floats, open ends, links (predecessor and successor) and logic are common in their assessments. However, only 80% of the respondents update their CPM regularly when their project is running (see Figure 8).

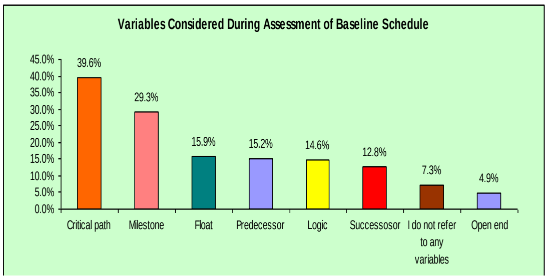


Figure 7: Variables Considered During Assessment of Baseline Schedule

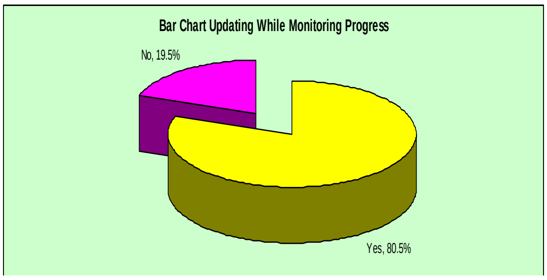


Figure 8: Updating / Maintaining CPM

Weekly and monthly updating are the most popular due to the need to prepare weekly or monthly progress reports. 8% of the respondent does not update schedules at all (see Figure 9). Daily reports / site dairy, weekly reports, monthly reports, correspondences and site instruction are the most common documents referred to when updating the CPM (see Figure 10).

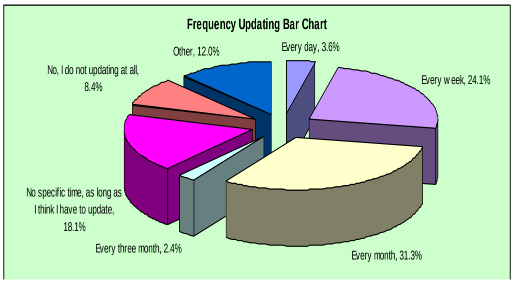


Figure 9: Frequency in Updating CPM

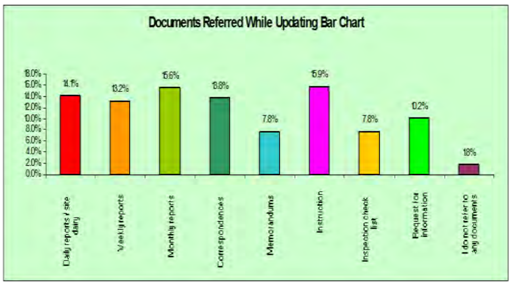


Figure 10: Type of Documents Referred While Updating the CPM

3.4 Techniques Used to Assess Delays

Figure 11 shows the types of Delay Analysis Technique used. The 'As-Planned vs. As-Built' comparison method emerge to be the most popular technique adopted. The other three techniques are not very popular. The 'But-For' and 'What'-If' techniques are the most unpopular with the lowest result at 1.1% and 3.3% respectively. 25.3% of the respondent reported that they are not sure what type of delay analysis techniques were used in assessing delay.

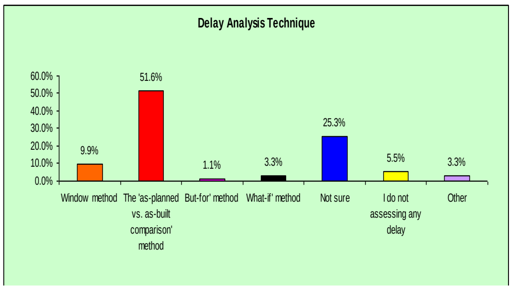


Figure 11: Delay Analysis Techniques

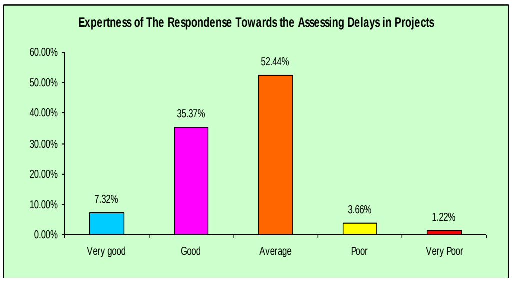
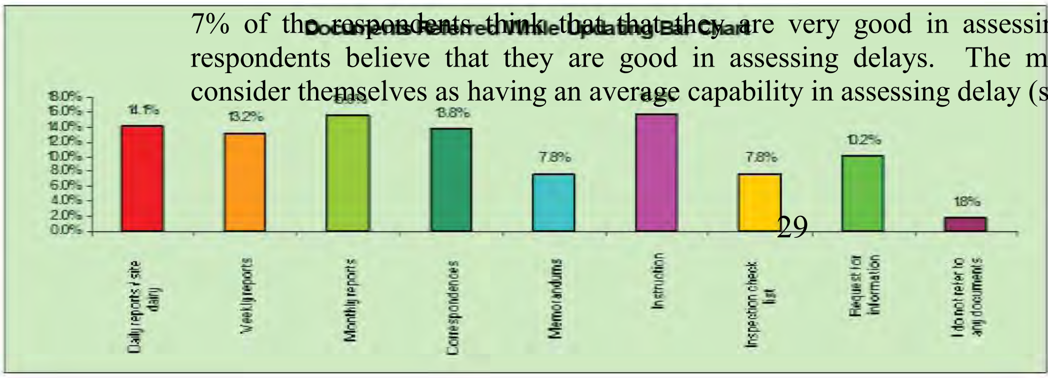


Figure 12: The Expertness of the Respondent Towards the Assessing Delays

7% of the respondents think that that they are very good in assessing delays while 35% of the respondents believe that they are good in assessing delays. The majority of respondent (55%) consider themselves as having an average capability in assessing delay (see Figure 12).



4. DISCUSSION ON THE FINDINGS

Concurrent with the study by Sambasivan & Soon (2007), 87% of the construction projects involved by the respondents in this survey experience delays. About 5% of the projects experience delays by more than 30%. This tends to infer that there are weaknesses in the way projects are managed and this need to be addressed. While Microsoft Project is the most popular software being used and as many as 30% of the respondents has not used any project management software at all. 30 % is a very significant proportion, and if this is taken to reflect the scenario of the industry as a whole, this could be one of the key factors that contribute to the issues of disputes in EOTs.

The use of the 'Baseline Schedule' to determine CPM is the most common technique chosen when monitoring and controlling the progress on site. However, this method is incomprehensive enough to be able to capture all elements of delays effectively. Its drawback is its inability to take into account the necessary variables such as critical path, milestone, float, open ends and their links (predecessor and successor) to the duration of delay occurred.

While daily reports / site dairy, weekly reports, monthly reports, correspondences and site instructions are the referred documents to update the CPM, it is alarming to note that a significant proportion of the respondents (20%) do not update their CPM regularly. Only a small percentage of respondents (10%) believe that they are able to use the window type delay analysis. The window analysis is among the most effective technique to assess delays but it is 'expensive'. The scheduler must have a thorough knowledge in planning and project management plus proper training to be able to operate this software (Baram, 2000b)

5. CONCLUSION

There is some lack of knowledge and competency in some application of the right delay assessment technique among the parties involved in determining EOTs. There is reason to suspect that many delay analysis techniques might be poorly applied. It is obvious that some personnel in charged have very little knowledge on preparation of effective CPM, how it should be updated and monitored. Some of them are not aware of the implications of ineffective delay assessment techniques at all.

Knowledge on the application of CPM is central in ensuring that the right delay assessment technique is accurately applied. In the current era when competency in the application of technology can greatly assist to achieve this, the use of available software such as Microsoft Project or Primavera Project Planner should be considered as primary. High cost of procuring this technology should not overshadow the advantages and accurate determination of EOT durations offered by these tools. More provisions need to be introduced and enforced at the industry level to improve this situation. Professional institutions, the Malaysian Construction Industry Development Board (CIDB), and the other important industry stakeholders, together can take the lead roles to promote and encourage more serious awareness on the benefits of the application of the right delay analysis techniques. The way forward is to improve and imposed the educational, training and continuing professional development (CPD) modules which emphasise more serious learning on delays, how to manage them and appreciate the implications.

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