Causes of Delay and Cost Overrun in Malaysian Construction Industry

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Abstract The construction industry in Malaysia drives the economic growth and development of the country. However, the industry is plagued with delays and cost overrun which transforms what should have been successful projects to projects incurring additional costs, disagreements, litigation and in some cases abandonment of projects. This research studied the causes of delays and cost overrun in the industry and ranked them according to their perceived importance to the contractors, with a view to establishing those to be addressed by the contractors. Online questionnaires were used for data collection for this research. A total of 69 responses were analysed using principal component analysis (PCA) (factor analysis) to identify the main causes. The result of the analysis showed that delay in preparation of design document, poor schedule and control of time, delay in delivery of material to site, lack of knowledge about the different defined execution methods, shortage of labour and material in market, and changes in scope of work were the main causes of delay and cost overrun. The identified causes if properly addressed would reduce the rate of delays and cost overrun in construction projects, thus enhancing the economic growth and development of the country.

Keywords Cost overrun · Construction industry · Delays

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1 Introduction

The Malaysian construction industry accounted for between 11.9 and 13.1% of the national gross domestic product (GDP) of Malaysia in the four quarters of 2016 [1]. The construction industry in Malaysia plays a vital role in its economic growth. It offers job opportunities and increment to the people's quality of life by providing essential socio-economic infrastructures, such as offices, roads, houses and schools. Malaysia is progressively marching towards industrialization and the construction industry role is been enhanced at the same time with the aim of bringing to reality the needs and aspiration of its population [2].

Although this indicates that the infrastructural development and the economic growth in Malaysian which is been driven by the construction industry often experience delays and cost overruns. Consequently, the level of impact on the economy is affected due to the incurred cost that was not budgeted for, differences resulting from disagreements, litigations and abandonment in some cases [3].

Cost and time control in construction project has been one of the most important issues in construction since the emergence of the industry [4]. A successful project, in addition to satisfying quality output standards, must also satisfy time and budget objectives. Time and cost performance are fundamental criteria used in the assessment of how successful a project is. However, it is very common in the construction industry that projects are rarely completed on time which is as a result of issues emanating from ineffective cost and time controls [5]. Similarly, [6] stated that the two major concerns in managing construction projects are cost and time control. Most of the features of projects that give rise to delay and cost overruns vary most times alongside with the project type, location, sizes and scopes. However, construction projects are becoming more complex as they now involve many stakeholders from different disciplines. The management and control of cost and time in construction is fundamental to the success of many projects. A study that was carried out on cost overrun by Chartered Institute of Building (CIOB) in 2008 reported that 90% of public works projects have issues associated with cost overruns [7]. This shows that delay and cost overrun are global issues.

Specifically, the Malaysian construction industry has experienced numerous cases of project delays and cost overruns that have led to additional project costs and impacted negatively on the sector [8]. For instance, the industry, when compared to other industries in the country, has suffered approximately 20–25% decline in the last few years [9]. As a result, the Malaysian construction industry is regarded as the industry facing poor performance leading to failure in achieving effective and efficient cost and time management [10, 11].

Presently, a number of tools that can be used for cost and time control have been developed [12]. However, there are variations in functions, with some designed specifically for particular type of projects [13]. Some of these tools include Earned Value Management (EVM), Gantt Bar Charts, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) [14, 15]. In addition to the development of these tools, software packages have been developed to assist in the

use of these project control tools such as Microsoft Project, Primavera, Asta Power Project, etc. But, in spite of the development and use of these tools and software packages, construction projects still suffer delays and cost overruns.

Existing studies on the causes of delay and cost overrun in Malaysian construction industry have shown that time and cost performance are an important issue that needs to be addressed in the industry [2, 3, 16–19].

2 Related Studies

Previous researches conducted have shown that project delays are common and costly, and occur in almost every construction project, though to varying degrees and magnitude [2]. This makes the study of the causes of these delays imperative, if there were to be effective project management. As a result of the overriding importance of time for both the owner (in terms of performance) and the contractor (in terms of money), it is the source of frequent disputes and claims, often leading to litigations.

In Malaysia, the construction industry contributes to the economic expansion of the country and serves as an engine of growth [18, 20, 21]. However, the construction industry's contributions are been threatened by escalating cost and time overruns [17, 19, 22–24]. The delay factors most times vary from project to project [8]. Below are some of the causes of delay and cost overrun (Table 1).

This has shown that there have been several studies conducted on project delays and cost overruns globally. These studies, continuous research and advancement in technology for controlling delays and cost overrun in the industry, notwithstanding, delays and cost overrun still occur. This makes it an important issue to be studied frequently in order to develop means to solving this phenomenon. This research seeks to identify the major causes of delay and cost overrun in Malaysian construction industry from the viewpoint of contractors.

3 Methodology

This study adopted a quantitative methodology in the identification of the different causes of delay and cost overrun in Malaysian construction industry. A questionnaire survey was used as a data gathering tool. A draft copy of the questionnaire on causes of delay and cost overrun in the industry was developed and given to lecturers and postgraduate students. A revised questionnaire based on the above was then given to 10 respondents. These two steps helped in ensuring both face and content validity of the questionnaire, and ensured questions asked would be understood by respondents to the main questionnaire. Published tables were used for determining the sample size. The sampling frame for the study comprised of the G7 rated civil engineering construction companies that are registered with CIDB in the Klang region of

Table 1 Causes of delay and cost overrun

S. no.	Causes	Source
1	Poor site management and supervision, unforeseen ground conditions, project team slow rate in making decisions, changes in scope caused by initiated and necessary variations of work by the project sponsors	[25]
2	Changes initiated by the designers, weather, client requirement, late deliveries, site condition and economic conditions	[26]
3	Poor management of site, unforeseen ground conditions, change orders and poor decision-making	[25, 27]
4	Changes in design, poor planning and labour productivity. Poor site management, late payment, labour supply, improper planning, lack of experience, problems with subcontractors and shortage of materials	[18]
5	Client organisations delay in payments, modification of contracts, economic hardship, procurement materials, design changes, staffing issues, lack or unavailability of working equipment, poor supervision, mistakes during construction, poor site coordination, specification changes and labour disputes	[28]
6	Poor design, resource and labour shortages, poor project planning, inefficient contractor management, financial difficulties and change orders	[29]
7	Change in design	[30]
8	Financial problems and coordination problems	[2]
9	Delay factors such as shortage of materials, change orders, delay in payment of suppliers, poor management of site and late submission of drawings are the main causes of delay	[17]
10	Labour productivity, slow decision-making, inflation, material delivery and insufficient equipment	[31]
11	Contractors and factors associated with finance	[3]

Malaysia. Thus, sampling was confined to specific groups of construction companies who could provide the desired information set by the researchers. According to CIDB Malaysia (2016), there are 187 registered G7 rated construction companies in Klang region. From the published table used [32], the minimum sample size for the population study was set at 67 at ±10% precision level. Data collection was carried out using questionnaires, while SPSS version 23 was used for data analysis which focused on frequency distribution and descriptive analysis. While principal component analysis (PCA) using factor analysis was used in identifying the key causes of cost overrun and delays from the responses, the test for reliability of response items was based on Cronbach's alpha test.

4 Result and Discussion

The respondents of the questionnaire survey who are representatives of the different G7 rated companies had different backgrounds in terms of job positions, level of education, working experience and working experience with BIM. The distribution

of these variables was analysed using descriptive analysis. The summary of the respondents' distribution is shown in Table 2.

The result of the analysis of respondents' job position shows that (33.3%) been the highest percentage of respondents are engineers, followed by project managers with (20.2%), while only (7.2%) of the respondents were directors in their companies. More also, the frequency distribution of the respondents' level of education indicated that (49.3%) of the respondents have masters' degree (M.Sc.), and (40.6%) had B.Sc. educational qualifications. The result from the frequency distribution table (Table 2) also showed that (52.2%) of the respondents have more than 10 years working experience in the construction industry, and (30.4%) of the respondents have less than 5 years working experience in the industry. While only (17.4%) of the respondents have industry working experience between 5 and 10 years. The three characteristics of the respondents' (job position, level of education and industry working experience) showed that the respondents are qualified to answer the questions contained on the questionnaires used for this research. Most of the respondents are well educated and have substantial working experience in the industry which makes them valid respondents for the questionnaire administration.

The reliability and internal consistency of the questions were tested using Cronbach's alpha test. The scale reliability and internal consistency for the 19 items tested which is the alpha coefficient was 0.904. Similarly, Kaiser-Meyer-Olkin measure of sampling adequacy was 0.776, which is above the commonly suggested value of 0.600, while the Bartlett's test of sphericity was significant (χ^2 (171) = 697.262, $p < .01$). Table 3 shows the commonalities were all above 0.5, an indication that all the items have some common variance with one another. In view of the results of the above analyses, all the items (19) are suitable for the analysis. The principal component analysis was used for the analysis, because the principal aim of the analysis is to ascertain the main causes of cost overrun and delays in Malaysian construction industry.

Table 2 Frequency distribution of respondent's demographic characteristics

Variable	Level	Frequency	Percentage
Job position	Director	5	7.2
	Project manager	14	20.2
	Technical officer	7	10.1
	Engineer	23	33.3
	Architect	7	10.1
	Others	13	18.8
Level of education	B.Sc.	28	40.6
	M.Sc.	34	49.3
	Ph.D.	2	2.9
	Other	5	7.2
Industry working experience	Less than 5 years	21	30.4
	Between 5 and 10 years	12	17.4
	More than 10 years	36	52.2

Table 3 Communalities

S. no.	Items	Initial	Extraction
1	Poor schedule and control of time	1.000	.777
2	Delay in preparation of design documents	1.000	.765
3	Ineffective communication between stakeholders	1.000	.683
4	Changes in laws and regulations	1.000	.677
5	Low productivity of labour	1.000	.682
6	Lack of knowledge about the different defined execution methods	1.000	.793
7	Adherence to outdated/old construction methods	1.000	.799
8	Extreme weather and environmental conditions	1.000	.714
9	Delay in delivery of materials to site	1.000	.829
10	Poor budget and cost control	1.000	.762
11	Inaccurate estimates	1.000	.703
12	Lack of contractor/subcontractor's experience	1.000	.775
13	Error in technical documents	1.000	.740
14	Error during construction	1.000	.751
15	Changes in scope of work	1.000	.714
16	Poor contract management and experience of consultant	1.000	.778
17	Financial issues	1.000	.760
18	Shortage of labour and materials in market	1.000	.792
19	Low level of productivity of labour	1.000	.685
Extraction method: principal component analysis			

Six components with eigenvalues greater than one were found. The eigenvalues and total variance explained by the six components are shown in Table 4. The eigenvalues after Varimax rotation showed that the first factor explained (37.5%) of the variance, the second factor (10.12%) of the variance, the third factor (8.28%) of the variance, the fourth factor (7.23%) of the variance, fifth factor (6.12%) of the variance, while the sixth factor explained (5.37%) of the variance. These six factors explain (74.61%) factor structure of the total variance among the items.

The 'Varimax rotational matrix' in Table 5 shows the correlation of each of the items with the six components with eigenvalues greater than (1) that were selected. The correlation relationship ranges from (−1) to (+1) indicating the strength of the relationship. The minimum criteria for the correlation of the variables with the extracted components are set at 0.4. None of the items were eliminated as they all contribute to the simple factor structure and meet the minimum criteria of having a correlation of 0.4 with at least one of the extracted components. All of the variables have an acceptable positive correlations coefficient with at least one of the components. The variables with the highest correlation with each of the components can be named after the components as they show very high positive correlation with the components when compared to the other items [33].

Table 4 Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	7.125	37.498	37.498	7.125	37.498	37.498	2.794	14.708	14.708
2	1.923	10.119	47.617	1.923	10.119	47.617	2.438	12.833	27.541
3	1.573	8.278	55.895	1.573	8.278	55.895	2.378	12.515	40.056
4	1.374	7.233	63.128	1.374	7.233	63.128	2.324	12.229	52.285
5	1.162	6.117	69.244	1.162	6.117	69.244	2.296	12.085	64.370
6	1.020	5.369	74.614	1.020	5.369	74.614	1.946	10.243	74.614
7	.694	3.650	78.264						
8	.652	3.431	81.695						
9	.577	3.035	84.729						
10	.563	2.961	87.691						
11	.438	2.307	89.998						
12	.387	2.036	92.034						
13	.335	1.762	93.795						
14	.311	1.634	95.430						
15	.264	1.387	96.817						
16	.201	1.060	97.876						
17	.179	.945	98.821						
18	.131	.690	99.511						
19	.093	.489	100.000						

Extraction method: principal component analysis

Table 5 Rotated component matrix

S. no.	Items	Component					
		1	2	3	4	5	6
1	Poor schedule and control of time		.826				
2	Delay in preparation of design documents	.841					
3	Ineffective communication between stakeholders			.680			
4	Changes in laws and regulations				.371		.595
5	Low productivity of labour			.647			
6	Lack of knowledge about the different defined execution methods					.842	
7	Adherence to outdated/old construction methods					.816	
8	Extreme weather and environmental conditions		.382	.622			
9	Delay in delivery of materials to site			.830			
10	Poor budget and cost control	.397	.692				
11	Inaccurate estimates	.530	.471				.385
12	Lack of contractor/subcontractor's experience		.436		.612	.449	
13	Error in technical documents	.477					.558
14	Error during construction		.595		.357		.355
15	Changes in scope of work						.799
16	Poor contract management and experience of consultant	.764					
17	Financial issues	.626			.389		
18	Shortage of labour and materials in market				.811		
19	Low level of productivity of labour				.737		

Extraction method: principal component analysis
Rotation method: Varimax with Kaiser normalisation

The first component had positive significant correlations with six (6) of the variables and had its highest correlation with the item 'delay in preparation of design documents'. The late submission of drawings, change orders and poor site management are among the main causes of cost overrun and delays in Malaysian construction industry [17]. The findings of this research have shown that this issue still exists in the industry.

More also, the second component had positive significant correlations with six (6) of the variables also and had its highest correlation with the item 'poor schedule and control of time'. Similar researches by Alaghbari et al. [2] and Kaliba and Muya [28] are in agreement with the findings of this research. Both authors

identified poor schedules and control of time as an important issue that needs to be addressed in order to reduce delays and cost overrun in the industry.

Similarly, the third component had positive significant correlations with four (4) of the variables and had its highest correlation with the item 'Delay in delivery of materials to site'. This is in agreement with the findings of Al-Momani [26] and Al-Tmeemy and Abdul-Rahman [31] that stated in their separate researches that the delay in the delivery of materials to the site is among the main causes of delay in construction projects.

While the fourth component had positive significant correlations with six (6) of the variables and had its highest correlation with the item 'shortage of labour and materials in market'. This is similar to the findings of Sambasivan and Soon [18] that shortage of materials in market and labour were among the main causes of delay and cost overrun in Malaysia.

The lack of knowledge about different defined execution models, poor contract management by consultant, governmental inefficiencies and mistakes in technical documents among others were findings of Abd El-Razek and Bassioni [34] on the causes of delay and cost overrun in Malaysian construction industry. This concurs with the result from the fifth component that had positive significant correlations with only three (3) of the variables and had its highest correlation with the item 'Lack of knowledge about the different defined execution methods'.

This is contrary to the findings of Alaghbari et al. [2] who conducted a study on the causes of delay in construction projects in Malaysia and found that 'financial problems' and 'coordination problems' were the two most important factors causing delay in construction projects in Malaysia. The sixth component had positive significant correlations with five (5) of the variables and had its highest correlation with the item 'changes in scope of work'. This concurs with findings of other researchers who conducted similar studies on the causes of delay in Malaysia and other countries. Changes in design (change in scope) are regarded as the most significant cause of poor time and cost control from practitioners point of view [30]. Similarly, Sambasivan and Soon [18] stated that predominantly, delays occur as a result of changes in scope, poor schedule and planning, and labour productivity. More also, in Thailand, the main causes of delay were identified to include poor project planning and control, change orders and many more [29]. The result of the study confirms the findings of these researchers and many more in stating that changes in the scope of work are among the main causes of delay in construction projects.

5 Conclusion

The result from the analysis showed delay in preparation of design document, poor schedule and control of time, delay in delivery of material to site, lack of knowledge about the different defined execution methods, shortage of labour and material in market, and changes in scope of work as the main causes of delay and cost overrun.

This implies that even with the advancement of technology, the Malaysian construction industry still faces set back due to the occurrence of these causes of delay and cost overrun. However, studies have shown that the use of advanced technologies such as Industrialised Building Systems (IBS) and Building Information Model (BIM) reduces the occurrence of these causes. The industry in collaboration with the government will need to put in more effort in creating awareness and the need for the use of these advanced technologies in order to reduce the occurrence of these causes of delay and cost overrun. More also, the identified causes if properly addressed using the suggested advanced technologies, should reduce the occurrence of delays and cost overrun. This will in turn increase the economic growth and development of the country at large.

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