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Significant Factors Causing Cost Overruns in Large Construction Projects in Malaysia

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Abstract: Once a construction projects fails in achieving effective cost performance, it will result to cost overrun. These overruns are caused from several factors which are very important to uncover for improving the cost performance. In Malaysia, not many research works have been carried out on studying cost performance factors. Hence, this study was conducted to identify the significant factors causing cost overrun in large construction projects in Malaysia. Questionnaire for the survey was developed based on 35 common factors of cost overrun identified from literature work. These factors were grouped in 7 categories and validated by interviewing five experienced personnel of construction industry. The feedback of from the survey resulted in receiving 262 sets of completed valid responses against 400 questionnaires distributed amongst contractors, consultants and clients involved in large construction projects. The data from the questionnaire was analyzed statistically. Relative importance index method was used for hierarchal assessment of factors and found that the top 3 most significant factors of cost overrun are fluctuation of prices of material, cash flow and financial difficulties faced by contractors and poor site management and supervision. These factors belong to two categories i.e., contractor's site management and financial management category, thus improvements in these categories are paramount for controlling cost overrun in construction projects.

Key words: Cost performance, construction industry, factors of cost overrun, large projects, Malaysia

INTRODUCTION

Construction industry is an important industry that plays a vital role in the socio-economic growth of a country. Economically, it contributes in significant improvement in the overall GDP of a country. It also improves the quality of life by providing the necessary infrastructure such as roads, hospitals, schools and other basic and enhanced facilities. Hence, it is fundamentally crucial to make construction projects completed successfully within time, budget and expected quality. However, being a complex, fragmented and schedule driven industry it always facing chronic problems such as low quality and productivity, cost overrun, time overrun, construction waste and others. Of these, cost overrun is a severe problem (Cantarelli, 2009, Olawale and Sun, 2010) because it affects the overall development of any country.

Cost overrun is a global phenomenon in the construction industry where very rarely projects are finished within the budgeted cost. In a global study (Flyvbjerg *et al*., 2003) on construction project performance, cost overrun was identified the major problem where 9 of 10 projects faced the overrun in the range of 50 to 100%. Construction industry in developed countries like UK is also affected by this problem where nearly one third of the client's complaint that their projects generally overran the allocated budget (Jackson, 2002; Olawale and Sun, 2010).

Like other countries, Malaysia also facing a serious issue of cost overrun in construction industry where only 46.8% of public sector and 37.2% of private sector projects were completed within the stipulated budget (Abdullah *et al*., 2009; Ibrahim *et al*., 2010; Sambasivan and Soon, 2007). The issue of cost overrun has become a serious concern to investors, which needs stern attention and in-depth research to put forward solutions to this issue. Hence, this study focused on assessing significant factors contributing to cost overrun issue in Malaysian construction industry particularly in large construction project where the contract tender amount is more than RM 5 Million.

LITERATURE REVIEW

Cost performance is the most important indicator of project success (Frimpong *et al*., 2003; Olawale and Sun, 2010). It presents not only the firm's profitability but also the productivity of organizations at any point during the construction processes. It can be seen in the project

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account and is always used to measure project performance. Generally, construction industry has been facing poor cost performance which describes inability to complete project within budget. This chronic issue is experiencing worldwide and becoming more alarming as shown in a study of 258 projects in 20 nations which cost approximately US$90 billion with the size ranging from US$1.5 million to $8.5 billion (Flyvbjerg *et al*., 2003). The study detected that almost 9 out of 10 projects facing cost overrun with an average of 28% of the forecasted costs and trend of cost performance has not improved over the time for the past 70 years. Similarly, investigation on 87 projects (29 road projects, 28 rail projects and 30 fixed link projects) conducted by Cantarelli (2009) revealed that cost overrun was the common problem at an average of 10.3% of project cost. His study showed that the percentage of cost overrun in road projects was the highest with the rate of 18.5% followed by rail projects with 7.6% and finally fixed link project with 4.5%. In Bosnia and Herzegovina, a study of 53 building projects including 29 new construction and 24 reconstruction projects showed that cost overrun in reconstruction projects was higher than new construction project. In reconstruction project the percentage of cost overrun was found at an average of 9.23% while for new construction projects it was 6.84% (Zujo and Car, 2008).

In Malaysia, a study on 359 projects (308 public and 51 private projects) found only 46.8% and 37.2% of public sector and private sector projects completed within the budget respectively with average cost deviation of 2.08% (Endut *et al.,* 2009). Further, in MARA large construction project study, it revealed that more that 90% of large MARA construction project experienced delay since 1984 due to time and cost overrun (Abdullah *et al*., 2009).

The cost overrun generated is caused by ineffective construction management and poorly established cost control systems (Sriprasert, 2000). Other factors affecting cost overrun include inadequate/inefficient equipment, tools and plant, unreliable sources of materials on the local market and site accidents (Kousliki and Kartam, 2004). A study on UK's construction industry, Olawale and Sun (2010) identified 21 major factors causing cost overrun are design changes, risk and uncertainty associated with projects, inaccurate evaluation of project's time/duration, non-performance of subcontractors and nominated suppliers, complexity of works, conflict between project parties, discrepancies in contract documentation, contract and specification interpretation disagreement, inflation of prices, financing and payment f or completed works, lack of proper training and experience of project manager, low skilled manpower, unpredictable weather conditions, dependency on imported materials, lack of appropriate software, unstable interest rate, fluctuation of currency/exchange rate, weak regulation and control, project fraud and corruption and unstable government policies. While in Gaza, study conducted by Enshassi *et al*. (2009) found that top 10 factors causing cause cost overrun include increment of materials prices due to continuous border closures, delay in construction, supply of raw materials and equipment by contractors, fluctuations in the cost of building materials, unsettlement of the local currency in relation to dollar value, project materials monopoly by some suppliers, resources constraint: funds and associated auxiliaries not ready, lack of cost planning/monitoring during pre-and post contract stages, improvements to standard drawings during construction stage, design changes and inaccurate quantity take-off.

Similarly, in vietnam Le-Hoai *et al*. (2008) found that top 5 significant factors causing cost overrun in large construction project are poor site management and supervision, poor project management assistance, financial difficulties of owner, financial difficulties of contractor; design changes. In a study of infrastructure projects in Nigeria, it was found that the major factors of cost overrun were price fluctuations, financing and payments of completed works, poor contract management, schedule delay, changes in site conditions, inaccurate estimates, shortage of material, imported materials and plant items, additional works, design changes, subcontractors and nominated suppliers, weather, non-adherence to contract conditions, mistakes and discrepancies in contract conditions and fraudulent practices (Omoregie and Radford, 2006). While for telecommunication projects studied by Ameh *et al*. (2010) indicated that top seven factors were lack of experience of contractors, cost of material, fluctuation in the prices of materials, frequent design changes, economic stability, high interest rates charged by banks on loans received by contractors, mode of financing, bonds and payments as well as fraudulent practices and kickbacks. These identified factors are part of the whole literature review on the factors causing cost overrun happening worldwide. Comprehensive review conducted has resulted in identifying 35 common factors of cost overrun which were considered for further investigation to find the relevancy and significance of these factors towards Malaysian construction industry. The identified factors are categorized in seven groups as presented in Table 1.

Table 1: Common factor of cost overrun identified

Causes of cost overrun	Sources
Category 1: Contractor's Site Management Related Factors (CSM)	
Poor site management and supervision	Harisaweni (2007), Le-Hoai *et al.* (2008) and Memon *et al.* (2010)
Incompetent subcontractors	Le-Hoai *et al.* (2008) and Omoregie and Radford (2006)
Schedule Delay	Harisaweni (2007) and Omoregie and Radford (2006)
Inadequate planning and scheduling	Ameh *et al.* (2010), Azhar *et al.* (2008), Enshassi *et al.* (2009), Frimpong *et al.* (2003), Harisaweni (2007), Olujide and Owosagba (2001) and Memon *et al.* (2010)
Lack of experience	Ameh *et al.* (2010), Enshassi *et al.* (2009), Olujide and Owosagba (2001), Kaming *et al.* (1997), and Memon *et al.* (2010)
Inaccurate Time and Cost estimates	Frimpong *et al.* (2003), Harisaweni (2007), Olujide and Owosagba (2001), Le-Hoai *et al.* (2008) and Omoregie and Radford (2006)
Mistakes during construction	Frimpong *et al.* (2003), Le-Hoai *et al.* (2008) and Omoregie and Radford (2006)
Inadequate monitoring and control	Azhar *et al.* (2008), Frimpong *et al.* (20030) and Harisaweni (2007)
Category 2: Design and documentation related factors (DDF)	
Frequent design changes	Ameh *et al.* (2010), Azhar *et al.* (2008), Enshassi *et al.* (2009), Frimpong *et al.* (2003), Harisaweni (2007), Le-Hoai *et al.* (2008), Memon *et al.* (2010), Oladapo (2007), Omoregie and Radford (2006)
Mistakes and Errors in design	Le-Hoai *et al.* (2008), Oladapo (2007)
Incomplete design at the time of tender	Enshassi *et al.* (2009)
Poor design and delays in design	Oladapo (2007)
Delay Preparation and approval of drawings	Omoregie and Radford (2006)
Category 3: Financial management related factors (FIN)	
Cash flow and financial difficulties faced by contractors	Frimpong *et al.* (2003), Le-Hoai *et al.* (2008) and Memon *et al.* (2010)
Poor financial control on site	Ameh *et al.* (2010), Azhar *et al.* (2008)
Financial difficulties of owner	Frimpong *et al.* (2003), Kaming *et al.* (1997), Le-Hoai *et al.* (2008), Moura *et al.* (2007) and Oladapo (2007)
Delay in progress payment by owner	Frimpong *et al.* (2003)
Delay payment to supplier/subcontractor	Moura *et al.* (2007) and Omoregie and Radford (2006)
Contractual claims, such as, extension of time with cost claims	Enshassi *et al.* (2009)
Category 4: Information and communication technology related factors (ICT)	
Lack of coordination between parties	Ameh *et al.* (2010), Azhar *et al.* (2008), Enshassi *et al.* (2009) and Oladapo (2007)
Slow information flow between parties	Enshassi *et al.* (2009), Frimpong *et al.* (2003) and Le-Hoai *et al.* (2008)
Lack of communication between parties	Long *et al.* (2004) and Memon *et al.* (2010)
Category 5: Labour Management Related Factors (LAB)	
labour productivity	Harisaweni (2007) and Moura *et al.* (2007)
Shortage of site workers	Ameh *et al.* (2010), Azhar *et al.* (2008), Frimpong *et al.* (2003), Harisaweni (2007), Memon *et al.*(2010) and Moura *et al.* (2007)
Shortage of technical personnel (skilled labour)	Frimpong *et al.* (2003), Harisaweni (2007) and Le-Hoai *et al.* (2008)
High cost of labour	Ameh *et al.* (2010), Azhar *et al.* (2008) and Kaming *et al.* (1997)
Labour Absenteeism	Moura *et al.* (2007)
Category 6: Material and machinery related factors (MMF)	
Fluctuation of prices of materials	Ameh *et al.* (2010), Azhar *et al.* (2008), Enshassi *et al.* (2009), Frimpong *et al.* (2003), Olujide and Owosagba (2001), Kaming *et al.* (1997), Le-Hoai *et al.* (2008), Memon *et al.* (2010) and Omoregie and Radford (2006)
Shortages of materials	Frimpong *et al.* (2003), Harisaweni (2007), Le-Hoai *et al.* (2008), Moura *et al.* (2007) and Omoregie and Radford (2006)
Late delivery of materials and equipment	Frimpong *et al.* (2003), Harisaweni (2007) and Moura *et al.* (2007)
Equipment availability and failure	Frimpong *et al.* (2003), Harisaweni (2007) and Moura *et al.* (2007)
Category 7: Project management and contract administration related factors (PMCA)	
Poor project management	Azhar *et al.* (2008), Le-Hoai *et al.* (2008)
Change in the scope of the project	Azhar *et al.* (2008), Enshassi *et al.* (2009), Frimpong *et al.* (2003), Harisaweni (2007), Olujide and Owosagba (2001), Kaming *et al.* (1997), Memon *et al.* (2010), Moura *et al.* (2007) and Oladapo (2007)
Delays in decisions making	Enshassi *et al.* (2009), Frimpong *et al.* (2003) and Memon *et al.* (2010)
Inaccurate quantity take-off	Enshassi *et al.* (2009) and Kaming *et al.* (1997)

DATA COLLECTION AND ANALYSIS

Quantitative approach was used to understand the perception of construction's professionals in Malaysia towards factors influencing construction cost at construction projects by conducting questionnaire survey. An ordinal scale of measurement was applied for data measurement in questionnaire survey. Ordinal scale used in this study was adopted from (Enshassi *et al.*, 2009) i.e. N.S. = not significant (0%); S.S. = slightly significant (25%); V.S. = very significant (75%) and E.S. = extremely significant (100%). However, abbreviations were replaced with numbers i.e. 1 for not significant (0%); 2 for slightly significant (25%); 3 for moderately significant; 4 for very significant (75%) and 5 for extremely significant (100%).

Prior to data collection work, a preliminary study was carried out by conducting interview with 5 experienced personnel who are involved in construction industry. This was done to validate the contents of questionnaire for its relevancy with Malaysian construction industry. Table 2 shows the profile of the respondents interviewed.

Table 2 indicates that the interviewed respondents had extensive experiences in handling construction projects ranging from 16 years to 29 years. The total professional experience of the 5 respondents is 114 years (average experience of 22.8 years). The respondents are senior employees of their companies and holding executive and managerial positions. Thus, it can be summarized that the respondents had enough technical background and experience to verify the questionnaire contents. Hence, data was collected using this developed structured questionnaire.

The gathered data was analyzed using statistical software package SPSS v17 to determine the hierarchal factor of cost overrun. The ranking of factors was calculated based on Relative Importance index (RII) value. RII value was calculated with the following expression:

$$RII = \frac{\sum_{i=1}^{5} w_i x_i}{A \times N}$$

Where:

RII = Relative importance index
w = Weighting given to each factor by respondents and it ranges from 1 to 5
x = Frequency of ith response given for each cause
A = Highest weight (i.e. 5 in this case)
N = Total number of participants

RESULTS AND DISCUSSION

Structured questionnaire survey was carried out by distributing a total of 400 questionnaire sets. It has been distributed randomly to 150 contractors firms, 150 consultant firms and 100 client personnel. Of which 274 responses were received back in a period of 10 months. However, some of the questionnaire sets were incomplete which were considered invalid and not suitable for further analysis as in Table 3.

Respondent's demographics: The respondents involved in the survey had several years of experience in handling various types of projects. The characteristics of the respondents participated in survey are summarized in Table 4.

Table 2: Profile of respondents interviewed for content validity

No	Organization	Designation	Experience
1	Client	Project engineer	29 years
2	Consultant	Principal consultant	24 years
3	Consultant	Project manager	23 years
4	Contractor	Managing director	22 years
5	Contractor	Project manager	16 years

Table 3: Summary of survey conducted

Parameters	Values
No of questionnaire distributed	400
No of responses received	274
No of invalid (Incomplete) responses	12
No of responses	262
% of responses received	68.5
% of valid responses	65.5

Table 4: Demographical of respondents

Parameters	Frequency	%age	Cumulative%
Type of organization			
Client	52	19.8	19.8
Consultant	92	35.1	55.0
Contractor	118	45.0	100.0
Type of projects			
Building	76	29.0	29.0
Infrastructure	83	31.7	60.7
Build-Infra	103	39.3	100.0
Size of projects			
6-10 million	45	17.2	17.2
10-50 million	90	34.4	51.5
Above 50 million	127	48.5	100.0
Working experience			
0-5 years	32	12.2	12.2
6-10 years	61	23.3	35.5
11-15 years	56	21.4	56.9
16-20 years	36	13.7	70.6
More than 20 years	77	29.4	100.0

Table 5: Reliability test results

Category	Cronbach alpha
Contractor's site management (CSM)	0.780
Design and documentation (DDF)	0.898
Financial related factors (FIN)	0.881
Information and communication technology (ICT)	0.846
Labour management (LAB)	0.900
Material and machinery resources (MMF)	0.893
Project management and contract administration (PMCA)	0.785
Overall data	0.946

Table 4 indicates that majority of the respondents (45% respondents) are working with contractor organizations followed by consultant and client firms with a percentage of 35.1 and 19.8, respectively. All the respondents had experienced in handling large projects i.e., projects with contract amount of worth more than RM 5 million. They involved in handling both type of projects i.e., building and infrastructure. Majority of the respondents had working experience of more than 5 years. A significant number of respondents i.e., 29.4% of respondents are engaged in construction industry for more than 20 years; 13.7% of respondents have experience of more than 16 years and 56.9% respondents

Table 6: Ranking of factors causing cost overrun

	Overall		Contractor		Consultant		Client		
Factors of cost overrun	RII	Rank	RII	Rank	RII	Rank	RII	Rank	Category
Fluctuation of prices of material	0.83	1	0.87	1	0.81	1	0.8	1	MMF
Cash flow and financial difficulties faced by contractors	0.78	2	0.79	2	0.74	6	0.8	2	FIN
Poor site management and supervision	0.76	3	0.75	5	0.78	2	0.8	5	CSM
Lack of experience	0.76	3	0.76	4	0.78	2	0.7	8	CSM
Schedule delay	0.75	4	0.74	6	0.77	3	0.7	7	CSM
Inadequate planning and scheduling	0.74	5	0.73	7	0.75	5	0.7	6	CSM
Incompetent subcontractors	0.74	5	0.74	6	0.75	5	0.7	8	CSM
Mistakes and errors in design	0.74	5	0.74	6	0.73	7	0.8	4	DDF
Frequent design changes	0.74	5	0.74	6	0.75	5	0.7	9	DDF
Poor financial control on site	0.74	5	0.73	7	0.74	6	0.8	5	FIN
Financial difficulties of owner	0.74	5	0.74	6	0.78	2	0.7	12	FIN
Shortages of materials	0.74	5	0.77	3	0.71	9	0.7	6	MMF
Inaccurate time and cost estimates	0.73	6	0.73	7	0.75	5	0.7	8	CSM
Delay in progress payment by owner	0.73	6	0.77	3	0.72	8	0.7	15	FIN
Poor project management	0.73	6	0.72	8	0.75	5	0.7	6	PMCA
Mistakes during construction	0.72	7	0.72	8	0.73	7	0.7	12	CSM
Incomplete design at the time of tender	0.72	7	0.71	9	0.72	8	0.7	7	DDF
Poor design and delays in design	0.72	7	0.72	8	0.75	5	0.7	11	DDF
Changes in scope of study	0.72	7	0.72	8	0.73	7	0.7	10	PMCA
Inadequate monitoring and control	0.71	8	0.73	7	0.66	14	0.8	3	CSM
Delay payment to supplier/subcontractor	0.71	8	0.70	10	0.70	10	0.7	6	FIN
Contractual claims, such as, extension of time with cost claims	0.71	8	0.68	12	0.76	4	0.7	11	FIN
Lack of coordination between parties	0.71	7	0.71	9	0.70	10	0.7	7	ICT
Shortage of site workers	0.71	7	0.72	8	0.70	10	0.7	12	LAB
labour productivity	0.71	7	0.70	10	0.76	4	0.6	18	LAB
Delay Preparation and approval of drawings	0.70	8	0.73	7	0.70	10	0.7	14	DDF
Slow information flow between parties	0.70	8	0.69	11	0.73	7	0.7	10	ICT
shortage of technical personnel	0.70	8	0.68	12	0.76	4	0.7	15	LAB
High cost of labour	0.70	8	0.73	7	0.71	9	0.6	17	LAB
Delays in decisions making	0.70	8	0.73	7	0.69	11	0.7	13	PMCA
Lack of communication between parties	0.69	9	0.68	12	0.72	8	0.6	16	ICT
Late delivery of materials and equipment	0.69	9	0.70	10	0.69	11	0.7	13	MMF
Equipment availability and failure	0.67	10	0.65	15	0.68	12	0.7	11	MMF
Inaccurate quantity take-off	0.66	11	0.66	14	0.67	13	0.6	18	PMCA
Labour Absenteeism	0.64	12	0.67	13	0.64	15	0.6	19	LAB

have experience of less than 16 years. These indicate that respondents were competent enough and capable for participating in the survey.

Reliability analysis: Reliability test is conducted to check the stability and consistency of a data. It was carried out by using Cronbach α method that is widely adopted. Reliability of the data is considered at low level when Cronbach α is less than 0.3 which means the data is not reliable and cannot be accepted. Reliability is at high level when Cronbach α is more than 0.7 (Li and Wang, 2007; Wong and Cheung, 2005; Yang and Ou, 2008). In this study, Cronbach α was calculated using statistical software SPSS V17 as shown in table 5. Since, alpha value for each category as well as overall data is found higher than 0.7 which is considered at high level. This assures that the data is highly reliable for further analysis.

Ranking of causes of cost overrun: Hierarchal assessment of factors was carried out to determine ranking of the factors based on level of significant. It was assessed based on RII value and calculated for each group of respondents i.e. contractors, consultant and client; and also the overall respondents as presented in Table 6.

Table 6 shows that top 3 most significant factors of cost overrun ranked by overall respondents are fluctuation of prices of material, cash flow and financial difficulties faced by contractors and poor site management and supervision. These factors are elaborated in more detail in the following section.

Fluctuation of prices of material: Fluctuation of prices of materials was ranked as 1st place (RII = 0.83) as agreed unanimously by all the respondents and this finding is concurrence with the findings from other countries (Ameh *et al*., 2010; Azhar *et al*., 2008; Chimwaso, 2000; Elinwa and Buba, 1993; Enshassi *et al*., 2009; Le-Hoai *et al*., 2008). This factor can be attributed from various reasons such as monopoly of suppliers or unavailability of construction materials locally. Price fluctuation is also contributed from instability and inflationary rate of a country. This may be due to demand exceeding supply or accentuated by the creation of an artificial scarcity of goods. These fluctuations are reflected in increase cost of raw materials, labour, machinery, other ancillary materials and services. A national solution to this problem would effectively minimize cost overruns (Okpala and Aniekwu, 1988) such as creating an agency empowered to monitor and publish building cost indexes regularly (Olujide and Owosagba, 2001).

Cash flow and financial difficulties faced by contractors: This factor was found as 2nd major contributor to cost overrun with RII value of 0.78 as agreed by contractor and client groups while consultant's representative rated this factor as 6th rank. This is very true for contractors because they play very important role in success of any construction project especially for physical execution of works. Hence, adequate cash flow and financial stability of contractors is very critical in keeping construction progress as planned. This finding concurrently match with the findings on Vietnam construction industry (Le-Hoai *et al*., 2008), however this finding dose not coincide with the research finding conducted in Ghana as this factor was rated as 5th ranked (Frimpong *et al*., 2003).

Poor site management and supervision: All the respondents agreed that this factor is a major contributor to cost overrun however there is some disagreement in terms of ranking amongst the respondent groups. Consultant's group ranked this factor at 2nd place while contractor and client groups ranked this factor at 5th place. Poor site management and supervision factor is focusing more towards contractor group. It reflects the weakness and incompetence of contractors (Le-Hoai *et al*., 2008) and affects significantly on the cost performance (Ali and Kamaruzzaman, 2010). This factor can resulted to late compliance with statutory body's requirement, poor communication with sub-contractors and material suppliers significantly, thus affecting the progress of project. Construction industry in Indonesia also facing poor site management that lead to negative cost performance of project (Harisaweni, 2007).

CONCLUSION

Cost overrun is a severe problem faced by large construction industry in Malaysia. It is resulted from various factors which had been identified in this study. A total of 262 samples were found as valid and analyzed statistically using relative importance index method on 35 causative factors of cost overrun. It was found that three most significant factors causing cost overrun in Malaysia's construction are fluctuation of prices of material, cash flow and financial difficulties faced by contractors; and poor site management and supervision. Of these, 2 factors are contractor's site management related factors and 1 factor is financial related issue. These imply the need of urgent attention in improving contractor's performance to achieve substantial cost performance in avoiding project failure.

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