

Measures to Mitigate Causative Factors of Budget Overrun in Malaysian Building Projects

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Abstract: Completion of a construction within planned budget is one of the main criteria of project success. However, budget overrun has become a recurring phenomenon in construction industry, which can result in multiple negative effects such as loss of economy, disputes among construction stakeholders, project abandonment, and drop in construction activities. This study aims to identify factors causing budget overrun in Malaysian Building projects and then to establish mitigation measures for the identified significant causative factors. Literature review, questionnaire survey and interviews were used in this study. Detailed literature review results in identification of 28 causative factors of budget overrun. The significant causative factors of budget overrun in building projects in Malaysia were investigated through a questionnaire survey of 83 contractors, 57 clients and 40 owners. The feedback of questionnaire survey was analyzed statistically. It was revealed that the significant causative factors of budget overrun include improper planning, variation in materials price, poor site management, lack of communication between parties, frequent design changes, incompetent contractors, mistakes during construction, shortage of site workers, delay in material procurement, and low speed of decisions making. After questionnaire survey, interviews with 16 construction experts were carried out in order to develop mitigation measures for the top ten significant causative factors. Based on semi-structured interviews, a list of mitigation measures for each of the top ten significant causative factors were derived. The findings of this study can be useful for construction practitioners in controlling budget overrun and to achieve project success.

Keywords: Budget overrun, Causative factors, Mitigation measures, Building projects, Project success.

1. Introduction

Construction industry plays a major role in enhancing socio-economic development of a country since it contributes to Gross Domestic Product (GDP) and generates greater employment opportunities [1-4]. For a vibrant construction industry, successful completion of construction projects is vital. A construction project is considered as successful when it is completed within planned budget, in agreement with contract duration and good quality. However, majority of the construction projects worldwide are facing the issue of budget overrun. Budget overrun can also be termed as cost overrun, cost increase, cost variation and cost escalation [5-9]. Budget overrun can be defined as the difference between the actual cost and estimated cost at the time of project completion [10].

Budget overrun in construction projects has been studied in many countries. In Australia [11] cost performance was investigated in 49 samples of road

construction projects and it was revealed that average budget overrun was 13.55%. According to a study conducted by Kostka and Anzinger in 2016 [12] on budget overrun based on data of 165 different types of construction projects between the years 1962 and 2015, the outcomes of the study revealed that budget overrun significantly varies with type of projects and mean budget overrun was 78%. In the United States [13], investigating budget overrun in design and build (DB) projects using data of 418 DB projects from Design-Build Institute of America have found that more than 50% of the projects experienced budget overrun. In Qatar [14], examining the issue of budget overrun in 122 public projects constructed between the years 2000 and 2013, the results showed that 54% of the projects were affected by budget overrun. Meng [15] surveyed cost performance in 103 building projects, and his analysis on the survey data revealed that 25.24 % of the projects experienced budget overrun. Studies carried out in Thailand [16], South Korea [10], Pakistan [17, 18], and in Kuwait [6] also showed that

construction projects are regularly experiencing budget overrun.

Likewise, in other countries, the budget overrun is one of the main problems in all types of construction projects in Malaysia, and building projects have no exclusion. This is evidenced in a study conducted by Shehuet *al.* [19] has unveiled that a considerable number of sampled building projects suffered from budget overrun. The studies by several other researchers [20-22] also confirmed that Malaysian construction projects have been affected by budget overrun. Many studies have been carried out on the issue of budget overrun, however, most of the studies focused only on the causative factors of budget overrun, while less attention has been given to its remedies. Further, the causes of budget overrun vary depending upon type and size of projects [23]. Hence, the need for a detailed study on mitigation measures for causative factors of budget overrun in building projects is crucial. Mitigation measures can be defined as the process by which construction project practitioners introduces specific measures to reduce or eliminate possible factors leading to budget overrun.

Therefore, the objectives of this study are as follows:

- 1) to determine significant causative factors of budget overrun in Malaysian building projects
- 2) to propose mitigation measures for the significant causative factors of budget overrun.

2. Literature Review

Several researchers have performed studies on the factors causing budget overrun in different countries. Olawale & Sun [24] studied the causes of budget overrun in construction industry of United Kingdom. A questionnaire survey was carried out in 250 construction projects firms along with semi-structured interview among construction experts. Results of the research showed that the significant causative factors of budget overrun consist of frequent design changes, risk and uncertainties associated with projects, wrong evaluation of projects cost, underestimation of project duration, nonperformance of sub-contractors, conflicts among project stakeholders, and delayed payments for completed works. Many studies have been carried out globally to find out the main causes of budget overrun in construction projects by conducting questionnaire survey. Table 1 shows the causative factors of budget overrun found from various studies in different countries.

Table 1: Causes of Budget overrun in different countries

Country	Causes of budget overrun	Author
Pakistan	Owner interference, delay payment by contractor, inexperienced contractor, change in scope of project, delay in decision making	[17-18]
United Kingdom	Conflicts, project duration, incompetent of sub-contractor, delayed payment of completed	[24]

	works	
Turkey	Inappropriate planning, high cost labour, expensive machinery, lack of skilled labour, high price of land	[25]
Iran	Low quality materials, improper planning, financial difficulties by owner, unforeseen site conditions, variation orders, low bidding procedures	[26]
Oman	Uncertainty of US dollars, changes in government rules, late supply in delivery of materials, frequent design changes,	[27]
Uganda	Change in scope, poor monitoring, delayed payment	[28]
Ghana	Lack of monitoring, error in contract document, poor communication, variation in price of material, inaccurate cost estimates	[29]

3. Research Methodology

The methods for this study include the followings. Firstly, gathering of common causes of budget overrun: Twenty-eight common causes are collected through comprehensive literature review on the issue of budget overrun in different countries. Second, distributing questionnaire survey: A questionnaire based on the gathered causes of budget overrun was designed. The questionnaire survey consists of two parts. Part A was aimed to collect personal information of the survey respondents. Part B was aimed at assessing the perception of construction practitioners on causes of budget overrun in Malaysian building projects. A five-point Likert scale (i.e. 1= Not Significant, 2= Slightly Significant, 3= Moderately Significant, 4= Very significant, 5 = Extremely Significant) is used to categorize the causative factors of budget overrun. Data gathered in questionnaire survey is analyzed using statistical software SPSS V22 to check the reliability and validity of the collected data. Finally, conducting semi-structured interview session with construction experts: After analyzing the questionnaire survey data, semi-structured interviews were carried out. Its primary aim was to explore mitigation measures for the top ten significant causative factors of budget overrun. The data collected through semi-structured interviews was then analyzed using “Nvivo” software. This software simplifies the analyzed data for each of the categories formed earlier.

4. Results and Discussion

4.1 Questionnaire survey analysis

Prior to conducting the actual survey, a pilot study was carried out to review the design of questionnaire and check relevancy of the factors causing budget overrun

enlisted in questionnaire related to building projects in Malaysia. The design of questionnaire was improved based on analysis of the pilot study. The actual questionnaire survey was distributed to 300 construction practitioners involved directly or indirectly in handling of building projects in Malaysia. One hundred and eighty completed and valid questionnaire were returned yielding a response rate of 60%. The response rates from contractors, consultants and owner were 46.11%, 31.67% and 22.22% respectively. It shows that most of the surveyed participants amongst construction practitioners were contractors followed by consultants. With regards to working experience, 24.67% of respondents had at least 10 years of experience, 50.66 % participants had between 11 and 20 years while 24.67% had more than 20 years of experience. As for academic qualification level, 26.66 % of the respondents had master’s degree, 61.13% had bachelor’s degree, and 12.21% were diploma holders. It shows that the surveyed participants have had enough working experience and academic qualifications. SPSS V22 was used to analyze the collected data of questionnaire survey. Cronbach’s alpha coefficient is used to check the internal consistency reliability of questionnaire. It was found to be 0.875, which is more than 0.7, hence data gathered from questionnaire survey is reliable. The causes of budget overrun in Malaysian building projects was ranked based on their Relative Importance Index (RII) as shown in Table 2.

Table 2: Ranking of causes of budget overrun

Causes of budget Overrun	RII	Rank
Improper planning	0.91	1
Variation in materials price	0.90	2
Poor site management	0.88	3
Lack of communication between parties	0.86	4
Frequent design changes	0.85	5
Incompetent contractors	0.83	6
Mistakes During Construction	0.82	7
Shortage Of Site Workers	0.80	8
Delay in Material Procurement	0.78	9
Low Speed of Decision Making	0.77	10
Underestimate project duration	0.75	11
Inaccurate cost estimates	0.74	12
Unforeseen ground conditions	0.73	13
Low performance of subcontractors	0.71	14
Change the scope of the project	0.70	15
Late payments by clients	0.68	16
Low productivity of labour	0.67	17
Variation orders	0.65	18
Mistakes and errors in design	0.64	19
Poor project management	0.63	20
Poor contract management	0.62	21
Lack of Equipment availability	0.61	22
Financial difficulties faced by contractors	0.60	23
Lack of consultant experience	0.59	24
Using low quality materials	0.57	25
Poor financial control on site	0.56	26
Practice of assigning contract to lowest	0.55	27

bidder		
High cost of equipment	0.53	28

It can be seen from Table 2 that out of the 28 causative factors of budget overrun, the first 10 factors were identified as the significant factors causing budget overrun in building projects of Malaysia.

4.2 Questionnaire survey analysis

Semi-structured interviews were carried out with construction experts in order to explore mitigation measures for the top ten significant causative factors of budget overrun. A total of 16 semi-structured interview sessions were carried out. Each interviewee had more than 10 years of experience involving in building projects. Furthermore, all interviewees were highly qualified and among the senior officers within their organization. The semi-structured interviews were recorded, and later on the data was analyzed using Nvivo Software. Table 3 shows the list of suggested mitigation measures for each of the significant causative factors of budget overrun.

Table 3: Mitigation measures for significant causes of budget overrun.

Causes	Mitigation Measures
Improper planning	i) Ensure effective planning at early stage of the project. ii) All parties should understand their task. iii) Consider true constraints of market and logistics during planning.
Variation in materials Price	i) Acquiring Bulk of Materials. ii) Establish effective contract system with raw material suppliers. iii) utilize local materials.
Poor site management	i) Effective monitoring of the progress of construction activities. ii) Develop good working collaboration among site’s management staff. iii) Ensure the site’s management staff are well trained.
Lack of communication between parties	i) Using technology for improved communication. ii) Arrange workshops to spell out partner responsibility. iii) Establishment of protocol for clear communication. iv) Arrange regular meetings.
Frequent design changes	i) Client should actively involve in design stage. ii) Provide adequate time to the design stage. iii) Ensure effective site assessment.

Incompetent contractors	i) Select contractors having history of quality workmanship. ii) Regular communications between contractor and client. iii) Define contractor's scope of work clear and in details.
Mistakes During Construction	i) Assign experienced workers to repetitive tasks. ii) Technical training programs for manpower working on site. iii) Proper understanding site-drawings and specifications. iv) Proper mentoring system
Shortage Of Site Workers	i) Offer reasonable pay to workers ii) Improve working environment iii) Employ labour with multiple skills.
Delay in Material Procurement	i) Implement an effective logistics management for materials delivery. ii) Ensure sufficient quantity of materials on construction site.
Low Speed of Decision Making	i) Avoid centralization of decisions. ii) Ensure quick approval. iii) Effective flow of information among construction stakeholders.

Table 3 summarizes the top ten significant causative factors of budget overrun and its respective possible mitigation measures for building construction projects in Malaysia. Each of the significant causative factors has at least three possible mitigation measures as suggested by the experts of building projects in Malaysia. For the most significant factor causing budget overrun, which is improper planning, the possible mitigation measures include ensure effective planning at early stage of the project, all parties should understand their task and consider true constraints of market and logistics planning. For the second ranked factor which is variation in material price, its mitigation measures consist of acquiring bulk of materials, establishing effective contract system with raw material suppliers, and utilize local materials. Measures for the third ranked factor namely poor site management comprise effective monitoring of the progress of construction activities, develop good working collaboration among site's management staff, and ensure the site's management staff are well trained. The fourth ranked factor, which is lack of communication between parties, has mitigation measures such as using technology for improved communication, arrange workshop to spell out partner responsibility, establishment of protocol for clear communication, and arrange regular meetings. The suggested mitigation measure for the fifth ranked factor of frequent design changes include client should actively involve in design stage, provide adequate time to design stage, and ensure effective site assessment. Furthermore,

for incompetent contractors which is ranked as the sixth factor, its mitigation measures consist of selecting contractors having history of quality workmanship, regular communications between contractor and client, and define contractor's scope of work clear and in details. Measures for the seventh factor namely mistake during construction comprise assigning experienced workers to repetitive tasks, technical training programs for manpower working on site, proper understanding site-drawings and specifications, and proper mentoring system. Shortage of site workers, which is ranked the eighth factor, has mitigation measures of offering reasonable pay to workers, improve working environment, and employ labour with multiple skills. The possible mitigation measures for the ninth ranked factor of delay in material procurement include implementing an effective logistics management for materials delivery and ensuring sufficient quantity of materials on construction site. Finally, for the tenth ranked causative factor of budget overrun in building projects of Malaysia, its mitigation measures consist of avoiding centralization of decisions, ensuring quick approval, and effective flow of information among construction stakeholders.

5. Conclusion

Budget overrun is one of the major problems in construction projects. This study analyzed the causes of budget overrun in building projects in Malaysia. Through questionnaire survey, 28 causes of budget overrun are identified, and several significant causative factors are unveiled which include improper planning, variation in materials prices, poor site management, lack of communication among project parties, and frequent design changes, etc. Furthermore, by conducting semi-structured interviews, in total 31 mitigation measures are determined for the significant causes of budget overrun. Each significant causes of budget overrun has minimum of three possible mitigation measures. The scope of this study limited to Malaysian building projects. The results of this study can be useful for construction practitioners in order to cope with issues of budget overrun.

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