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Relevancy of Factors and Mitigation Measures in Controlling Time and Cost Overrun Towards Malaysian Environment

Nadzirah Roslan[1, a *], Dr. Noor Yasmin Zainun[1,b]
and Dr. Aftab Hameed Memon[2,c]

[1]University Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor, Malaysia

[2]Quaid-e-Awam University of Engineering, Sciences and Technology, Pakistan

[a]nzierah@gmail.com, [b]nryasmin@uthm.edu.my, [c]aftabm78@hotmail.com

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Abstract. Construction projects are facing time and cost overrun globally. Since, this problem occurs due to various factors, hence for achieving successful construction projects, it is very important to control the responsible factors causing time and cost overrun. This study assessed the relevancy for each mitigation measures in relation with causative factors of time and cost overrun in Malaysian construction projects. A total of 56 mitigation measures were identified and correlated with the critical factors of time and cost overrun which were categorized into four phases of project life cycle. Data collection was done by conducting structured interviews amongst the experienced practitioners of the southern regions of Peninsular Malaysia.

Introduction

Issues of time and cost overrun in the construction industry have adversely affected the success of the projects globally. In studying the issue of cost overrun, [1] highlighted that the chronic problem of cost overrun in construction industry is not improved for the last 70 years where about 90% of project worldwide face this issue with an average cost overrun is 28%. Similarly, Malaysia's construction industry is also facing poor time and cost performance resulting in a huge amount of time and cost overrun [2]. In a survey by [3] reported that, a quite small number of responses with 11% mentioned that the projects were completed within the estimated time and cost. Thus, it is very important to control the time and cost overrun for achieving successful projects. For this, numerous models and methodologies have been developed over the past years. These developments mostly have focused in dealing with the cost estimation and managing escalations in projects, but still there is a significant knowledge gap emerging in establishing a reference the practices across the industry. Some researchers were proposed procedures and measures to reduce the delays [4]. However, those measures are general recommendation and suggestions, provide without matching with the causative factors of time and cost overrun. Whereas effective time and cost overrun can only be achieved when the root causes i.e. causative factors of time and cost overrun are addressed and controlled from occurrence. Thus, it is essential to understand the key factors that influence the performance of time and cost in order to improve project control as stated by [5]. The study in the construction industry of UK had suggested the mitigating measures with respect to the causative factors [5]. However, this study focused on five factors only i.e. design changes, risk or uncertainties, inaccurate evaluation of project time/duration, complexities and non-performances of subcontractors. While, there is a serious lack of studies on identifying suitable mitigation measures with respect to the nature and factors occurring in construction projects in Malaysia..

Further, effectiveness of mitigation measure in order to control the occurrence of the factors also depends on the stage of the project. Hence, this study considers the project classified into various phases that include planning phase, design phase, construction phase and finishing phase as adopted from [6]. The planning phase highlights detail plan as necessary to meet the requirement project's objective while design phase is a stage of a project where detailed plan and drawings are prepared

[6]. Besides, construction phase focuses on putting the project plan into motion and finishing phase emphasis on the construction of architectural and finishing work [6]. Thus, this study is focusing on determining mitigation measures in order to control the critical factors causing time overrun in Malaysian construction industry. Also, the relevancy of each mitigation measure is determined in accordance with the applicability throughout the project lifecycle of the construction projects.

Critical Factors of Time and Cost Overrun

This study is an extension of the research work carried out by [6] regarding identifying critical factors contributing to time and cost overrun as shown in Table 1 below where phase 1 represents planning phase, phase 2 is design phase, phase 3 as construction phase and phase 4 is finishing phase.

Table 1: Critical factors throughout project lifecycle

No	Factors	Phase 1	Phase 2	Phase 3	Phase 4
1	Poor site management and supervision	Not critical	Not critical	Critical	Critical
2	Incompetent subcontractors	Not critical	Not critical	Critical	Not critical
3	Schedule delay	Not critical	Not critical	Critical	Critical
4	Inadequate planning and scheduling	Not critical	Critical	Critical	Critical
5	Lack of experience	Not critical	Critical	Not critical	Not critical
6	Mistakes during construction	Not critical	Not critical	Critical	Critical
7	Cash flow and financial difficulties faced by contractors	Not critical	Not critical	Critical	Not critical
8	Delay payment to supplier /subcontractor	Not critical	Not critical	Critical	Not critical
9	Lack of communication between parties	Critical	Critical	Not critical	Not critical
10	Poor project management	Not critical	Not critical	Critical	Not critical
11	Change in the scope of the project	Critical	Critical	Not critical	Not critical
12	Delays in decisions making	Not critical	Critical	Not critical	Not critical

As seen from Table 1, critical factors in the planning phase are; lack of communication between parties; and change in the scope of the project. In design phase, there are five critical factors as inadequate planning and scheduling; lack of experience; lack of communication between parties; change in the scope of the project; and delays in decision making. Construction phase is considered as critical phase where 8 factors are; critical factors which are poor site management and supervision; incompetent subcontractors; schedule delay; inadequate planning and scheduling; mistakes during construction; cash flow and financial difficulties faced by contractors; delay payment to supplier /subcontractor; and poor project management. In finishing phase, there are four critical factors which include; poor site management and supervision; schedule delay; inadequate planning and scheduling; and mistakes during construction.

Data Collection

Data collection was carried out through structured interviews by using a questionnaire. The questionnaire focused on determining the relevancy of various mitigation measured identified from the literature review in relation with critical causative factors of time and cost overrun throughout various phases of the construction projects. The respondents were asked to marks Yes/No in order to mention whether the identified measure is relevant for the particular factor with respect the mentioned phase of project. The characteristics of the respondents are shown in Table 2.

Table 2: Demography characteristic of respondent

No.	Respondent	Academic Qualification	Experienced	Position in organisation
1	Local Authority	Degree	11 – 20 years	Director
2	Contractor	Diploma	11 – 20 years	Director
3	Public Work Department	Degree	31 years and above	Director
4	Contractor	Diploma	11 – 20 years	Director
5	Contractor	Master	21 – 30 years	Director
6	Contractor	Diploma	21 – 30 years	Director
7	Contractor	Diploma	11 – 20 years	Director

Gathered data was analysis through frequency analysis method which is a descriptive statistical method that shows the number of occurrences of each response chosen by the respondents.

Results and Discussion

The results obtained from the analysis of collected data regarding relevancy for applying mitigation measures to control time and cost overrun in construction projects in various phases is presented in Table 3. The experience practitioners also suggested the suitable mitigation measures for controlling the critical factors of time and cost overrun. Table 3 shows that majority of the respondents agreed with the relevancy of the identified mitigation measures in terms of the applicability in the planning phase for controlling time and cost overrun. However, only establish change control boards (CCB) was not relevant for control the factor of change in the scope of the project. Similarly, it is noted that for the factors occurring in design phase, the respondents agreed with all identified relative mitigation measured except one measures. For factor, change in the scope of the project regarding relative mitigation measure 'ensuring that no design change is made without the knowledge or authorization of the relevant party'. Thus, this mitigation measure is considered non-relevant and not applicable. In construction and finishing phases, majority of the respondents agreed with the identified relative mitigation measures in accordance with the critical factors.

Table 3: Relevancy of mitigation measures for controlling time and cost overrun factors

Phase 1: Planning Phase					
Factors	**Mitigation Measures**	**Relevancy (%) Time/cost**	**Fact-ors**	**Mitigation Measures**	**Relevancy (%) Time/cost**
Lack of communication between parties	Adopt clear information and communication channel	100/71	Change in the scope of the project	Owner must ensure they have adequate and available source of finance to meet their requirement scope	86/86
	Promote team building communication processes	100/43		Establish Change Control Boards (CCB)	43/43
	Respondents Suggestion: 1) Establish proper of organisation chart 2) Individual tasks responsibility 3) Establish a detail information management system to anticipate the achievement of client expectation during the preparation of project brief			Scope must be defined clearly from inception to completion	86/57
				Respondents Suggestion: 1) Political matters should be considered 2) Understand client request and expectation 3) Anticipate future expectation	
Phase 2: Design Phase					
Fact-ors	**Mitigation Measures**	**Relevancy (%) Time/cost**	**Fact-ors**	**Mitigation Measures**	**Relevancy (%) Time/cost**
Inadequate planning and scheduling	Promote team building communication processes	100/57	Change in the scope of the project	Identify the potential design changes and notify those changes to all relevant parties involved in the project at early stage	86/57
	Adopt clear information and communication channel	100/71		Ensuring necessary design changes are carried out immediately after they are recognized	71/57
	Choose experienced subcontractors with good reputation	86/71		Ensuring that no design change is made without the knowledge or authorisation of the relevant party	26/43
	Must ensure the timely availability of required finance	71/57		Respondents Suggestion: 1) Minimize changes in the design	

	Development of a proper system of site management and supervision	71/43		2) Responsibility of making certain required design changes based on site condition should be given to experienced site manager	
	Develops realistic planning and scheduling for the project	86/43			
	Respondents Suggestion: 1) Feasibility study must be done carefully 2) Monitor using management tool e.g. Critical Path Method				
Lack of experience	Selecting a consultant who has sufficient experience in similar nature of works and has a good reputation	86/57	Lack of communication between parties	Adopt clear information and communication channel	86/86
	Respondents Suggestion: 1) Tasks balance up with appointment of service 2) Verification and validation of experience from authentic or authorized referral i.e. professional institution			Promote team building communication processes	86/86
Delays in decision making	Avoid centralization of decisions especially those related to design changes	71/43		Respondents Suggestion: 1) Practical organisation of division and task responsibility to firm and practically	
	Quick design approvals	100/71			
	Respondents Suggestion: 1) Head of project team to must conduct meeting to inform every decision to staff promptly				

Phase 3: Construction Phase

Factors	Mitigation Measures	Relevancy (%) Time/cost	Factors	Mitigation Measures	Relevancy (%) Time/cost
Poor site management and supervision	Provide training to unskilled workers based on their scope of work	71/71	Inadequate planning and scheduling	Promote team building communication processes	86/43
	Educate/enhance knowledge of unskilled workers for their scope of work	100/71		Adopt clear information and communication channel	86/71
	Contractors should improve their project management skills and articulate their resources	100/71		Choose experienced subcontractors with good reputation	71/57
	Appoint competent site managers	100/71		Must ensure the timely availability of required finance	71/100
	Development of a good monitoring and controlling system	86/57		Development of a proper system of site management and supervision	100/57
	Adopt clear information and communication channel	71/71		Develops realistic planning and scheduling for the project	100/57
	Development of a proper activity monitoring system	71/57		Respondents Suggestion: 1) Arrange frequent of progress meeting 2) Establish CPM with detailed WBS	
	Respondents Suggestion: 1) Develop competent teams for executing works 2) Establish resource management 3) Monitor daily activity to cater for the required resource 4) Evaluate quantify work done on regular				
Incompetent subcontractors	Select experienced and capable subcontractors	100/71	Poor project management	Establish training program to increase the knowledge of project management techniques	100/71
	Respondents Suggestion: 1) Financial ability to consider as a part of qualification 2) Provide necessary training to sub-contractors 3) Understanding of subcontractor right in contract e.g. PWD 203 N			Respondents Suggestion: 1) Establish project management knowledge of skill 2) Avoid frequent design changes	
Schedule delay	Adopt effective and efficient material procurement systems	86/71	Mistakes during construction	Hire competent labour	100/71
	Allocate adequate contingency allowance	57/57		Promote open communication	71/57
	Respondents Suggestion: 1) Allow extension of time 2) Perform proper calculation of project duration 3) Establish resource schedule during early stage of project			Respondents Suggestion: 1) Arrange regular site meetings to discuss working methods for ongoing activities 2) Adopt current technology 3) Follow the schedule	
Cash flow and financial difficulties faced by contractors	Development of a comprehensive financial plan and cash flow	57/57	Delay payment to supplier/subcontractor	Progress payments to sub-contractor/supplier must be made on time	86/100
	Development of a cost monitoring and periodical reporting of critical and long lead items	57/57		Respondents Suggestion: 1) Adopt deed of assignment whereby client pays to supplier/ sub-contractors directly	
	Respondents Suggestion: 1) Check current financial status of the contractor before awarding the project 2) Progress payment to contractors should be followed according the schedule				

Phase 4: Finishing Phase					
Factors	**Mitigation Measures**	**Relevancy (%) Time/cost**	**Factors**	**Mitigation Measures**	**Relevancy (%) Time/cost**
Poor site management and supervision	Contractors should improve their project management skills and articulate their resources	100/71	Mistakes during construction	Hire competent labour	86/71
	Development of a good monitoring and controlling system	86/86		Promote open communication	71/57
	Adopt clear information and communication channel	86/71		Respondents Suggestion: 1) Check design and required resources before execution of works	
	Respondents Suggestion: 1) Select competitive contractors				
Schedule delay	Hire competent labour	86/57	Inadequate planning and scheduling	Promote team building communication processes	100/71
	Promote open communication	86/43		Adopt clear information and communication channel	86/71
	Adopt effective and efficient material procurement systems	86/26		Choose experienced subcontractors with good reputation	86/71
	Proper financial plan must be prepared to ensure timely procurement of material	86/57		Must ensure the timely availability of required finance	86/71
	Adequate material plan must be prepared to ensure the regular availability of required materials	100/57		Development of a proper system of site management and supervision	100/43
	Respondents Suggestion: 1) Monitor work program continuously for improvement 2) Offer attractive incentives for early completion of project			Develops realistic planning and scheduling for the project	86/57
				Respondents Suggestion: 1) Conduct mind mapping technique, brain storming session before planning the project	

Conclusion

This study has determined several measures to mitigate critical factors occurring in construction project of Malaysian which result in time and cost overrun. The relevancy of each mitigation measure in terms of applicability was determined through questionnaire interviewing experience practitioner involved in handling construction projects. From statistical analysis of the interviews, it was found that 56 out of 58 mitigation measures were relevant to apply in construction industry of Malaysian for controlling the critical factors of time and cost overrun.

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