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

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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.
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.

| 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     | 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 measures 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 mark 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 | Mitigation Measures | Relevancy (%) | Phase 2: Design Phase | Mitigation Measures | Relevancy (%) |
|------------------------|---------------------|---------------|------------------------|---------------------|---------------|
| Factors                |                     |               | Factors                |                     |               |
| Lack of communication | Adopt clear information and communication channel          | 100/71        | Change in the scope of the project | Establish Change Control Boards (CCB) | 43/43         |
| between parties        | Promote team building communication processes              | 100/43        |                        | Respondents Suggestion: | 86/57         |
| respondents            | Respondents Suggestion: 1) Establish proper of organisation chart |               |                        | 2) Understand client request and expectation |               |
|                        | 2) Individual tasks responsibility                         |               |                        | 3) Anticipate future expectation |               |
|                        | 3) Establish a detail information management system to anticipate the achievement of client expectation during the preparation of project brief |               |                        | Respondents Suggestion: |               |
|                        | Time/cost Time/cost |               |                        | Scope must be defined clearly from inception to completion |               |
|                        | Owner must ensure they have adequate and available source of finance to meet their requirement scope |               |                        | Respondents Suggestion: |               |
|                        | 86/86                                                          |               |                        | 1) Minimize changes in the design |               |
|                        | 71/57                                                          |               |                        | 2) Minimize design changes and notify those changes to all relevant parties involved in the project at early stage | 86/57         |
|                        | 43/43                                                          |               |                        | 3) Ensure that no design change is made without the knowledge or authorization of the relevant party | 26/43         |

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Development of a proper system of site management and supervision  
Develops realistic planning and scheduling for the project  
Respondents Suggestion:  
1) Feasibility study must be done carefully  
2) Monitor using management tool e.g. Critical Path Method

Selecting a consultant who has sufficient experience in similar nature of works and has a good reputation  
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

Avoid centralization of decisions especially those related to design changes  
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 (%) | Factors | Mitigation Measures | Relevancy (%) |
|---------|---------------------|---------------|---------|---------------------|---------------|
| Poor site management and supervision | Provide training to unskilled workers based on their scope of work | 71/71 | Poor project management | Establish training program to increase the knowledge of project management techniques | 100/71 |
| | Educate/enhance knowledge of unskilled workers for their scope of work | 100/71 | | Respondents Suggestion:  
1) Establish project management knowledge of skill  
2) Avoid frequent design changes |
| | Contractors should improve their project management skills and articulate their resources | 100/71 | | |
| | Appoint competent site managers | 100/71 | | |
| | Development of a good monitoring and controlling system | 86/57 | | |
| | Adopt clear information and communication channel | 86/57 | | |
| | Development of a proper activity monitoring system | 71/57 | | |
| | 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 quantity work done on regular | | | |
| | Select experienced and capable subcontractors | 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 | | | |
| | Adopt effective and efficient material procurement systems | 86/71 | | |
| | Allocate adequate contingency allowance | 57/57 | | |
| | Respondents Suggestion:  
1) Allow extension of time  
2) Perform proper calculation of project duration  
3) Establish resource schedule during early stage of project | | | |
| | Development of a comprehensive financial plan and cash flow | 57/57 | | |
| | Development of a cost monitoring and periodical reporting of critical and long lead items | 57/57 | | |
| | 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 | | | |
| | Delay payment to supplier/subcontractor | 86/100 | | |
| | Progress payments to sub-contractor/supplier must be made on time | | | |
| | Respondents Suggestion:  
1) Adopt deed of assignment whereby client pays to supplier/ sub-contractors directly | | | |
Phase 4: Finishing Phase

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