

DEVELOPING MITIGATION MEASURES FOR DELAYS IN BUILDING CONSTRUCTION PROJECTS: A CASE STUDY IN THE CITY OF ISFAHAN, IRAN

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ABSTRACT

Developing mitigation measures are to avoid or minimize the magnitude of adverse consequences of delay causes that could threaten the project objectives in terms of time, cost and quality. It is also vital to be aware of mitigation measures within the construction industry. The aim of the study reported in this paper is to develop mitigation measures for delays in building construction projects in the city of Isfahan, Iran. A questionnaire survey was used to carry out the study which was filled out by professional parties such as clients, contractors, architects, project managers, consultants and developers in the construction industry. Feedbacks from respondents gave variety of measures for each cause of delay to mitigate the adverse and disruptive consequences of delay causes in building construction projects in Isfahan. Time and cost overrun were the common negative effects of delays in building construction projects in Isfahan. The study has found that twenty one significant mitigation measures based on the different points of view from respondents of the questionnaire survey, in order to avoid or minimize the causes of delays in building construction projects in Isfahan, it has been proposed that the top six most effective mitigation measures of avoiding or minimizing these delays were further elaborated. This include: considering the clients views while providing designs, setting the project budget according to proper and accurate estimations, efficient and effective project management among the parties in the project, proper selection of competent and capable contractors appropriate for the project, appropriate delegating of project parties regarding to their specialties and skills and also having sufficient knowledge of project environment and project parties before the project starts. It is hope that this finding will be able to address issues and problems of delays in building construction projects in general in Iran.

Keywords: Project Objectives, Construction Project Delays, Adverse Consequences, Mitigation Measures, Iran

1. INTRODUCTION

A construction project is commonly acknowledged as successful when the aim of the project is achieved in terms of predetermined objectives that are mainly completed the project on time, within budget and specified quality of the project. One of the most important problems in the construction project could be delays that could occur in every construction project and the significant of these delays varies considerably from project to project. Any disruptions to the project objectives will certainly contribute to project delays with its specified adverse effects on project objectives. Hence, mitigation measures for delays in construction projects are in order to avoid the negative consequences of delays in construction project that could treat the project success that is basically to gain the project objectives that are classically

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defined by the need to complete a project on time, within the budget, with appropriate quality and moreover health and safety factors.

Next part will be on literature review including the causes of construction delays, effects and minimizing construction delays, followed by research methodology consisting of research design, research sample, data collection and data analysis. Conclusion of this research will be continued after the results and discussions part.

2. LITERATURE REVIEW

2.1 Causes of Construction Delays

Delays are common and the probability of occurrence is high in construction projects. There are many factors that contributed to causes of delays in construction projects. These range from factors inherent in the technology and its management, to those resulting from the physical, social, and financial environment. Assaf et al., (1995) studied the causes of delays in large building construction projects in Saudi Arabia. Their results illustrated that the most important causes of delay were included: approval of shop drawings; delays in payment to contractors and the resulting cash problems during construction; design changes; conflicts in work schedules of subcontractors; slow decision making and executive bureaucracy in owner's organizations; design errors; labor shortage and inadequate labor skills.

Ogunlana et al., (1996) studied the delays in building project in Thailand, as an example of developing economies. They concluded that the problems of the construction industry in developing economies can be nested in three categories: problem of shortages or inadequacies in industry infrastructure, mainly supply of resources; problems caused by clients and consultants; and problems caused by incompetence of contractors.

Odeyinka & Yusuf (1997) identified the major causes of delays in building projects in Nigeria were categorized the causes of delay as project participants and extraneous factors. In their study they concluded client-related delays included variation in orders, slow decision-making and cash flow problems. Whereas the contractor-related delays identified were financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems and shortage of manpower. Extraneous causes of delay identified were inclement weather, acts of God, labor disputes and strikes.

According to Murali Sambasivan et al., (2007) stated that the problem of delays in the construction industry is a global phenomenon and the construction industry in Malaysia is no exception. Ten most important causes that were identified in their study included: (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problems with subcontractors, (6) shortage in material, (7) labour supply, (8) equipment availability and failure, (9) lack of communication between parties and (10) mistakes during the construction stage. They also recommended in their research that six main effects of delay were: (1) time overrun, (2) cost overrun, (3) disputes, (4) arbitration, (5) litigation and (6) total abandonment.

2.2 Effects and Minimizing Construction Delays

Delays could be common and the probability of occurrence may be high in construction projects. There are many factors that contributed to causes of delays in construction projects ranging from a variety of factors related to the technology, management to those factors deriving from the physical, social, and economic environment. Delays may give extremely rise to disruption of project activities that will eventually resulted to decreasing the productivity, delay of completion to the project, increasing the time that will enhance the project costs, third party claims that could be arisen and if they could not be solved then it will cause project abandonment or termination of contract (project).

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According to the literature as illustrated in below table (Table 1), six major effects of delay in the construction projects were identified that includes time overrun, cost overrun, dispute, arbitration, total abandonment and litigation.

Table 1: Effects of Delay Causes

Author	Effects of Delay Causes
Aibinu and Jagboro (2002)	Time overrun, cost overrun, dispute, arbitration, total abandonment and litigation.
Lim (2004)	Extension of time and arbitration.
Koushki and Kartam (2004)	Time overrun and cost overrun
Murali et al., (2007)	Time overrun , arbitration and litigation
Wiguna and Scott(2005)	Cost overrun
Shi et al., (2001)	Time overrun
Lim Chong Fong (2004)	Time overrun, Cost overrun, disputes and claims

According to Table 1 it is concluded that most of the authors agreed that the major effects of delay causes are time overrun and cost overrun which could have adverse consequences on our project objectives in terms of time, cost and quality.

Mitigation measures are in order to minimize or avoid the adverse consequences of delays in construction projects. Based on the authors as shown in below table (Table 2) these minimizing factors (Mitigation factors) for delay causes includes:

Table 2: Minimizing of Delay Causes (Mitigation Factors)

Author	Minimizing of Delay Causes (Mitigation Factors)
Nguyen et al., (2004)	Availability of resources, multidisciplinary/competent project teams, competent project manager, commitment to projects, frequent progress meeting, accurate initial cost estimates, accurate initial time estimates, awarding bids to the right/experience consultant and contractor, proper emphasis on past experience, community involvement, systematic control mechanism, comprehensive contract documentation, effective strategic planning; clear information and communication channels, use up to date technology utilization and absence of bureaucracy.
Aibinu and Jagboro (2002)	Acceleration of site activities and contingency allowance.
Odeh and Battaineh (2002)	Enforcing liquidated damage clauses and offering incentives for early completion, developing human resources in the construction industry through proper training and classifying of craftsman, adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors and adopting new approaches to contracting such as design-build and construction management (CM) type of contracts.
Koushki et al., (2005)	The availability of adequate funds, allocation of sufficient time and money at the design phase, selection of a competent consultant and a reliable contractor to carry out the work.

Based on Table 2 it can be resulted that most of the authors agreed that the major mitigation factors for minimizing of delay causes are adequate client's funds, selection of a competent contractor and having the multidisciplinary/competent project teams that could also enhance the success of construction projects.

3. METHODOLOGY

3.1 Research Design

This research begins with collecting, reviewing and analyzing the background information that are obtained from:

- Review relevant literature including seminars, project management, journals, newspapers, the internet, relevant books and in particular make a comprehensive review of the construction industry in Iran.
- Discussion with various professional parties in the building projects such as clients, contractors, architects, consultants and developers, relevant departments in the construction industry in Isfahan.
- A questionnaire survey to find out the mitigation measures for delay causes within the building construction projects in Isfahan was conducted. The questionnaire was developed to assess the perceptions of professional parties in the building construction projects such as contractors, architects, civil engineers, project manager and developers of the relative importance of the mitigation measures for causes of delay. The developed survey questionnaire was distributed to the targeted respondent in the city of Isfahan in Iran.

3.2 Research Sample

This section explains how the survey was conducted, how many questionnaires were sent and received and how the questionnaires were distributed.

How the questionnaires were distributed? In 14 zones of Isfahan, 5 questionnaires were sent for each zone in Isfahan. The postal survey was conducted in 4 months with a total of 70 questionnaires that were distributed to the relevant respondents and 43 of them replied. Out of 43 replied questionnaires 5 of them were not responded properly. Therefore these 5 questionnaires were identified as invalid due to vastly incomplete answers. Table 3 illustrates the response rate.

Table 3: The response rate

Number of questionnaire sent	70
Number of replied questionnaire	43
Number of missed questionnaire	5
Percentage of complete replied to total sent questionnaire	54%

3.3 Data Collection

The survey was based on information gathering as well as data generation. The data is based on the amount of information on the parameter or variables from existing practices in implementing the building construction projects. Generally it has been grouped into the following categories:

- The company background.
- The responded opinions, information and background.
- Developing the mitigation measures for delay causes in building construction projects in the city of Isfahan.

Table 4: Respondents Job title

Job title	Frequency	Percent (%)
Contractor	6	15.8 %
Civil Engineer	4	10.5 %
Architect	4	10.5 %
Project Manager	17	44.7 %
Developer	7	18.4 %
Total	38	100.0 %

Approximately 45% of the respondents were Project Managers, about 18% of them were Developers and almost 16% of the respondents were contractor. In addition just 10.5% of the respondents were Civil Engineers and another 10.5% of respondents consist of Architectures.

3.4 Data Analysis

Most of the data is analyzed descriptively. Statistical packages SPSS (Statistical Packages for Social Science) was used to analyze correlation between variables. Respondents data was categorized in SPS and than they were analyzed for exploiting the results of this research that will be discussed in the next part, (Results and discussions).

There is an example of how mitigation measures were developed for the causes of delay that was calculated in SPSS. For instance, client changes influences on delay.

Table 5: Client changes influences on delay

Influence Level	Frequency	Percent (%)	Cumulative Percent (%)
Less Influence	9	23.7 %	23.7 %
High Influence	29	76.3 %	100.0 %
Total	38	100.0 %	

9 respondents out of 38 respondents indicated that client changes had less influence on delay. Majority of respondents that were 29 respondents agreed that client changes had high influence on delay in building construction projects.

Those respondents who indicated that client changes had high influence on delay in building projects that were 29 respondents indicated there reasons and solutions to mitigate the high influence of client changes in the project on delay as showed in below table:

Solutions	Number of Respondents
A) Accurate primary feasibility studies in providing the designs for the clients to prevent design mistakes	
B) Considering the clients view while providing designs	
C) Participating the client or his representative into the construction stage	

Table Description: TR=Total Respondents (Those respondents who had rate the cause as high influence on delay).As illustrated in this Table solutions to mitigate the high influence of client changes on delay had been specified by different colors for example:
 Those respondents who mentioned their first solution which is 1) Accurate primary feasibility studies in providing the designs for the clients to prevent design mistakes is shown by green color (■), solution number 2 is shown in brown color (■) and solution number 3 is shown in pink color (■). Those respondents who agreed on two solutions that were A and B are shown by purple colour (■). Those respondents who mentioned about two solutions which are B and C is shown by light blue colour (■). Those respondents who mentioned about three solutions to mitigate the high influence of client changes on delay which are A, B and C is shown light green colour (■).The most significant critical solution that is agreed from majority of the respondents (19out of 29) for mitigating the high influence of client changes on delay is shown in red color (■).

The same way was applied to describe the high influence of those causes on delay in building construction projects from those respondents who had rate the causes as high influence cause on delay. In each table there were some solutions regarding of selected cause as high influence cause on delay from respondents perception that were described and also each of the solutions, (mitigation measures) were counted for those respondents selecting more than one solution.

4. RESULTS AND DISCUSSIONS

Based on this research, the most significant effective mitigation measures to avoid or minimize the magnitude of causes with high influence on delay were found to be:

1. Efficient and effective project management among the parties in the project.
2. Considering the clients views while providing designs.
3. Effective communications among the parties involves in supply chain management.
4. Employing competent and skilful project managers.

The total results that were identified from this research are illustrated in the following figure, (Figure 1).

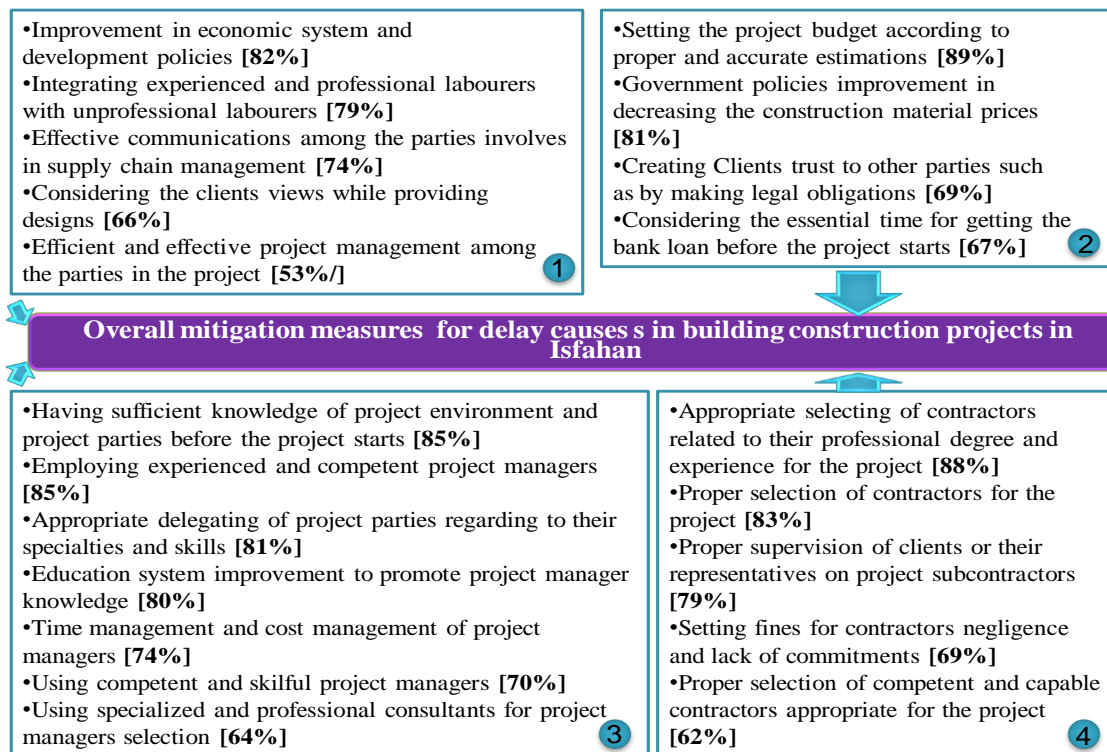


Figure Description:

The percentages illustrated in above figures are concluded from the division of the most critical reason or solution that is agreed by those respondents who agreed on the solution in to the total respondents who had solutions for that cause for example: In the category of contractors improper project manner on delay in building construction projects in Isfahan the most solution that was agreed with 88 % was calculated by dividing the most significant critical reason (solution) that is agreed from majority of the respondents (28 out of 32) following with their specified solution which was appropriate selecting of contractors related to their professional degree and experience for the project) for mitigating the high influence of contractors inadequate experience and knowledge of the project on delay.

- 1 Mitigation measures for general causes of delay in building construction projects in Isfahan
- 2 Mitigation measures for clients financial problems on delay in building construction projects in Isfahan
- 3 Mitigation measures for lack of project managers hard skills (Technical skills) and soft skills (People skills) on delay in building projects
- 4 Mitigation measures for contractors improper project manner on delay in building construction projects

Figure 1: Diagram of overall mitigation measures for delay causes in building construction projects in Isfahan

There are several recommendations of mitigation measures in order to handle the causes of delay, also to improve the current situation of construction industry especially the success of building construction projects to achieve their objectives in Isfahan. Based on the findings of this study, the most significant mitigation measures were related to the factors of insufficient funds of clients in financing the project that should be more concerned before the projects starts. Contractors improper project manner have a critical role in directing a project to delay issues such as cost overrun, time overrun and suspension of the project therefore it is strongly recommended that the significant mitigation measure is that more time should be given in selecting the competent and appropriate contractors for the project such as by selecting experienced and professional consultants.

Project managers selection should be based on their skills and competencies to suit the project in achieving its defined objectives namely time, cost and quality. It is a well know fact that decisions made early in the life of a project have the most absolute and extensive effect on the project success in achieving its defined project objectives of delivering a quality and safe project within the specified time and allocated budget for the project. Besides that, the governmental role in providing stable and healthy economic situation for construction market that can guarantee the development policies of construction industry is significantly critical that can enhance the confidence level, a leading force and encourage the parties involving in building projects such as clients and contractors to move along with their projects and getting away with causes of delay in construction industry will be surely the significant mitigation measures in building construction projects in the city of Isfahan.

Some of the delay causes such as inflation and destabilization of economy not merely effect construction industry but the whole of the economy. Therefore, the main mitigation measures to avoid or minimize the delay causes is that government has to shoulder their responsibly to provide proper and healthy breeding ground for the construction industry. This study thus provides the professional parties involving in building construction projects to select appropriate strategies that may be adopted to avoid or mitigate the adverse consequences of delay causes in building construction projects in Isfahan that could threat the project objectives in terms of time, cost and quality by focusing on the mitigation measures that have been provided for this propose.

5. CONCLUSIONS

Developing the mitigation measures in building construction projects has been recognized as a significant process in order to avoid or minimize the negative consequences of delay causes that could threaten the project objectives in terms of time, cost and quality. Time and cost overrun were the common negative effects of delays in building construction projects in Isfahan. The study has found that twenty one significant mitigation measures based on the different points of view from respondents of the questionnaire survey, in order to avoid or minimize the causes of delays in building construction projects in Isfahan, it has been proposed that the top three most effective mitigation measures of avoiding or minimizing these delays were further elaborated. This include: considering the clients views while providing designs, setting the project budget according to proper and accurate estimations and also having efficient and effective project management among the parties in the project. Furthermore, the population of Iran is young and there are huge demands for residential buildings. In Isfahan there is a vast need for more building construction projects including residential projects that could probably face the delay issues. Therefore, it will certainly leads us to recognize and develop the significant mitigation measures to avoid and minimize the negative consequences of factors causing to delays in building construction projects which were also identified in this research.

6. ACKNOWLEDGEMENT

The authors would like to thank Universiti Teknologi Malaysia for sponsoring this research through grant number Q.K130000.7140.01J58.

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