

Effects of Delay in construction Projects of Punjab-Pakistan: An Empirical Study

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ABSTRACT

The objective of the present study was to measure the effects of delay in construction projects like cost-overflow, time-overflow, litigation and project abandonment. Data on the study variables has been collected through structured questionnaire from 37 construction firms located in Punjab province of Pakistan. Participants were approached personally to collect the data. Various statistical tools such as reliability test, factor analysis, common method variance, normality test, Independent Sample T-test, One-Way ANOVA, correlation, computation of means and standard deviations and structural equation model have been applied for data analysis and inference. It is found that delay in construction projects significantly lead to cost overrun, time overrun, litigation and project abandonment. The findings of the study also provide significant insights to construction industry so that they may formulate strategies in order to avoid delay and its consequences. Moreover, the recommendations and limitations are discussed in the conclusion part of the study.

KEYWORDS: *Construction Projects, Delay, Cost overrun, Time overrun, Litigation, Abandonment*

1. INTRODUCTION

As Pakistan is developing country, therefore construction industry plays an important role in the expansion and economic development of Pakistan [1]. Delay in construction projects is a problem facing by the whole world [2]. Completion of construction projects contributes in the economic development by the effective use of cost and time as a whole, which results in saving the cost for the country [3]. Factors which cause delay in the construction projects also have some effects on the overall project[4]. In a study conducted by [3]regarding Nigerian construction industry, the researchers have found the effects of delay in construction projects of Nigeria. According to the authors' time overrun, cost overrun, disputes, arbitration, and abandonment are the main effects of construction delay in Nigerian construction projects. Later on,[5] carried out a study in Malaysia for his thesis and used the same scale as [3] and added one more variable "litigation" in it. Moreover the author reveals that according to contractors and consultant, cost overrun and time overrun are the most common effects of construction delays. Time overrun, cost overrun, abandonment, negotiations and court cases and disputes are the main effects of project delay in the construction industry of Pakistan[1]. In Pakistan, the factors which are causing delay in construction projects are related to contractor, client/owner, consultant, material, equipment, labor and general environment [4].

When there is delay in construction projects, they are either expedited or the scheduled time for the completion of project, is extended. The result is cost overrun in both the cases. Main reason of cost overrun in the construction projects are the delays in the delivery of materials to the project sites in the developing countries[6]. Other major factors which are responsible for time overrun in the construction projects are revision and approving of design documents, delay in getting approval for major changes during the project, delay in sub-contractor work and the conflicts in sub-contractor schedule in project execution[5].Low communication between the project parties, changes made by the owners, contractor's inadequacy during work and poor planning are the main causes of cost overrun [1]. During the construction projects there are some factors which cause disputes among the project parties.

Problem Statement:

The infrastructure development play vital role in order to improve the development and progress of any country. Many construction projects in Pakistan have been facing serious problems due to which construction projects cannot be completed in time [7]. On the other side, delay in construction projects leaves negative impact such as time and cost overrun, litigation and abandonment of whole project. The most adverse impact is it gives bad impression to foreign investors that ultimately lead to downward trend of national progress. According to [8], the

delays often occur due to poor management of various factors related to client, contractor and consultant of the projects. In addition, general conditions including weather, law & order situations and overall economic conditions becomes severe which causes delay in completion of projects. Hence there is a dire need to measure the effects of delay in construction projects of Punjab- Pakistan.

In order to fill the literature gap and to address the problem of construction industry of Pakistan, the present study is aimed at:

- Measuring the effects of delay in construction project like time-overrun, cost-overrun, litigation, and project abandonment.

2. LITERATURE REVIEW

Delay and Cost overrun

All over the world, various researches have been undertaken which indicates that the construction projects are facing delay in their completion. When there is delay in construction projects, they are either expedited or the scheduled time for the completion of project, is extended. The result is cost overrun in both the cases [9]. Similarly, [3] reported that cost overrun is the most common effect of construction delay in Nigeria. In the same line, [2] conducted a study in Malaysia and concluded that cost overrun is ranked at second number in the overall effects of construction delays. The reason behind cost overrun is the overtime cost which a company has to bear to accomplish the work which is resulted by delay [10]. Furthermore additional amount of money is required in order to overcome the construction mistakes committed during the construction work. Rework cost can be 10-15% more as compared to that of estimated cost [11]. Due to these factors cost overrun can be said as one of the most common effects of delay in construction industry [12]. Further the authors have concluded that according to contractors, cost overrun is the highly ranked effect in the construction industry.

Time overrun is the main reason of cost overrun [13]. This is also supported by [11] who concluded that schedule delay and budget overrun are directly related to each other, when there is time overrun in construction; cost of that project will also increase. Further they reported that during their survey, respondents were of the view that due to delay, the construction firms have to bear more cost of labor, equipment and tools. Therefore, it is hypothesized that:

Hypothesis 1: Delay in the construction project increases the cost of the project.

Delay and Time overrun

Researchers have found the effects of delay in construction industry. Time overrun is one of them. The most important factors responsible for time overrun are, fiscal problems and the payment for the completed work, inadequate contract management, changes in site situations, less availability and inadequate planning [14]

In their study, [2] have used an integrated approach and linked the causes and effects of delay through a systematic analysis. The researchers have concluded that client related and contractor related factors are very important for time overrun. Furthermore, the study reported that out of ten factors (responsible for time overrun) six factors are related to clients and contractors. Furthermore they identified factors such as improper contractor's planning, inadequate site management, low level project handling experience of contractors and late payment of work completed are the main reasons of time overrun in the construction industry. In the same line, [5] added that out of ten most important factors that are responsible for delay, at least five factors are such which are responsible for time overrun in the project. These factors are delay in revision and approval of design documents, delays in sub-contractors work, delay in approving major changes in the scope of work and conflicts in sub-contractors schedule in execution of project. Time overrun is one of the most important effects of delaying construction industry [3]. Thus the following hypothesis has been proposed:

Hypothesis 2: Delay in the construction project result in time overrun.

Delay and Litigation

There are only a few studies on the effects of delay. During data collection [3] asked their respondents to rank the occurrence of effects of construction delay on frequency basis according to their personal experience. In their study, they used Relative Importance Index (RII) to calculate the results. Litigation is on the 6th number with the RII value 0.296. Further they reported that when the arbitration does not works, and then the disputes are resolved through courts. [2] have used a questionnaire to collect the data from the respondents in which they tried to identify the effects of construction delay and the respondents were asked to give their opinion how the effects of delay can be minimized. According to [5] consultant related and contractor related factors are responsible for effects of delay. In order to identify the factors that cause delay in the construction projects and rank the effects of delay, he used the

mean value which represents the average indexes for the factors of delay. The value for the litigation is 2.91 which is ranked at number four in the overall effects of construction delay. According to [1] court cases is ranked at number four (RIR= 0.363). Further he reported that the no or late payment for the completed work, change orders etc. are the main reasons for litigation. After reviewing the relevant literature, the following hypotheses have been proposed to be tested in this study:

Hypothesis 3: Delay in Construction Projects has significant positive effects on Project litigation.

Delay and Abandonment

Factors related to consultants and contractor lead the project towards totally abandoned[5]. He used the mean value which also calculates the average indexes for the delay factors in order to rank the results. Abandonment stood at number four with the mean value 2.91 in the effects of delay. According to [15] total abandonment is ranked at number 4 in the overall effects of delay with RII value 0.456. According to [2], client based delay, consultant-based, labor based, and external factors pay to the overall abandonment of the projects. According to him, during the period of 1997 -2000 several projects were briefly abandoned due to financial problems. The main reasons of abandonment are organizational changes, regulatory changes, finances and payments, natural disasters etc.[1]. They calculated the relative importance ratio (RIR) ranges from 0 to 1. Lesser value of RIR represents more importance to that specific effect. The value for abandonment is 0.336, which is ranked at third position in the overall effects of construction delays. Moreover they have reported that in Pakistan, the main reasons for projects to be shortly or permanently abandoned financial crisis, natural disasters and organizational changes. Thus, based on the above literature, it is hypothesized that:

Hypothesis 4: Delay in Construction Projects has significant positive effects on Project abandonment.

3. RESEARCH METHODS

Target population for this study is construction firms based in Punjab province of Pakistan. List of construction companies obtained from the website of Pakistan Engineering Council (PEC). According to the list, there are 141 companies working in construction sector in Pakistan Punjab. The scope of these companies ranges from construction of household & commercial buildings to road, underpass, fly-over and working both in public and private sectors. Systematic random sampling technique has been used to choose the firms for data collection purpose. Out of total companies, 47 companies (33%) selected. Thus, every 3rd firm from the list has been selected to collect the information about the contractor, client, consultant, material, equipment, labor and general factors causing delay in project completion. After selecting the firms, questionnaire has been served to each key position holder like operation manager, procurement manager, marketing manager, HR manager etc. Approximately, there are 10 key positions in construction organization from which data will be collected. Total 470 questionnaires were administered and out of which, 172 questionnaire completed in all respect has been used for data analysis.

Measurement and Instrumentation:

Two items scale developed by Wei[5] used to measure the delay in construction projects. First item is about the number of projects delayed and is measured on five point Likert-type scale i.e. *1 = 0 Project; 2 = 1 to 5 projects; 3 = 6 to 10 projects; 4 = 10 to 15 projects and 5 = More than 15 projects*. The second item is about percentage amount of project delay out of estimated project duration and has been measured on five point Likert-type scale i.e. *1 = 0%; 2 = 0%1 to 10%; 3 = 11% to 20%; 4 = 21% to 30%; 5 = More than 30%*. To measure the negative outcomes of project delay such as time-overflow, cost-overflow, litigation and project abandonment, two items scale for each variables developed by Wei [5] has been used. The items are about the amount of cost overrun, time overrun, litigation and abandonment in term of number of projects and percentage of these variables. Frequency of these outcomes will be measured on five point Likert-type scale i.e. *1 = 0 Project; 2 = 1 to 5 projects; 3 = 6 to 10 projects; 4 = 10 to 15 projects and 5 = More than 15 projects*. The second item of each scale is about percentage amount of cost overrun, time overrun, litigation and abandonment and measured on five point Likert-type scale i.e. *1 = 0%; 2 = 0%1 to 10%; 3 = 11% to 20%; 4 = 21% to 30%; 5 = More than 30%*.

4. RESULTS AND DISCUSSIONS

Structural Equation Model

Table 1 represents model fitness indices for SEM (Structural Equation Model) for testing the casual relationship between dependent and predictor variables. The fitness indices fall in acceptable range. For example, relative chi square (CMIN/DF) is calculated to be 2.96. This ratio indicates model fitness when the calculate value is

below the upper limit of 5 [16]. Further support for model fitness value comes from the work of Marsh and Hocever[17] indicating that relative chi-square value as high as 5 and as low as 2 should be considered good. Other fitness indices like Goodness of Fit Index (GFI) Normed Fit Index (NFI) and Comparative Fit Index (CFI) are calculated to be 0.91, 0.92 and 0.94, respectively. The research indicates that the closer the values of these indicator to 1 the better the fitness of model [18]. Last fitness indicator is Root Mean Square Error of Estimation (RMSEA), where the value is calculated to be 0.10. The acceptable range for this ratio is below 1 for indicating model fitness [19].

Table 1: Fitness Indicators

CMIN	DF	CMIN/DF	GFI	NFI	CFI	RMSEA
97.97	33	2.96	0.91	0.92	0.94	0.10

Delay and Cost Overrun

Hypothesis-1 in table 2 scrutinizes the relationship between “Delay in construction projects” and “Cost Overrun”. The calculations reveal that Delay has a positive impact on cost overrun for sample of companies in current investigation. The relationship is positively significant with p value 0.01. Moreover, the β value is 0.75 representing that Construction Delays account for 75% of cost overruns. These statistics ($p=0.01$, $\beta=0.75$) indicate that the hypothesis 1 is accepted for current study.

Literature evidence is quite convincing for the impact of delay on cost overruns [12]. Delay causes more days of work and where more man hours and machine hours are to be deployed for completion of project. In this way, additional labor, machine and equipment cost is put to use leading to escalation in project cost. In Pakistani construction industry the element of delay in construction project is accounted for in previous studies [1].

Findings from Nigerian [3] and Malaysian [2] construction industries uncover the impact of delay in increasing overall project cost. Consequently, the construction firms are wary for such factors that lead to cost increments. For sampled construction firms, the average value of “Cost Overrun” stands near to 4. It is hence implied that cost overruns account for about 20% of all project portfolios for a construction company in sampled firms.

Rework costs are important part of cost overruns inflating the original estimated project cost by 10-15% [11]. The effect of reworking various kinds of activities related to project need time and money spent which directly contributes to cost of project. A construction project is adversely affected when companies run out of cash to support the construction process. In fact, delays cause budgets over run and hence the overall cost of the project is increased [11].

Table 2: Hypotheses Decision

Hypothesis No.	Independent Variable	Dependent Variable	Regression Co-efficient	Decision
H-1	“Delay”	Cost Overrun	0.75***	Accepted
H-2	“Delay”	Time Overrun	0.72***	Accepted
H-3	“Delay”	Litigation	0.67***	Accepted
H-4	“Delay”	Abandonment	0.31***	Accepted

***. Significant at the 0.01 level.

**. Significant at the 0.05 level.

*. Significant at the 0.10 level.

Delay and Time overrun

This hypothesis tests the relationship between Delay in construction projects and effect on time overrun. The findings reveal that delay in construction projects directly lead to time overruns. The relationship is significant with p-value 0.01. β coefficient for the relationship stands at 0.72. These statistical values ($p=0.01$; $\beta=0.72$) indicate that the hypothesis 2 stands accepted for sampled construction firms in Pakistan.

When construction projects are delayed, more time is needed for completion of projects. The mean value for time overrun in project construction is 3.61, indicating fair number of times a construction company faces in Pakistan. The research indicates that there are various kinds of reasons that delay a construction project and hence time overrun occurs. Research findings from Jordan reveals that client related factors are commonly responsible for project time overruns [20].

Similarly, rescheduling of task and activities by clients result in time overruns [21]. Frequent rescheduling and redesigning require more time for incorporating the changes to construction. Another source of delay, increasing time line of project completion, contractors and labor [22]. Some evidence from Hong Kong also supports the conclusion that client and contractor related factors cause time delays in project completion [23]. Although the list of factors causing delays and hence time overruns is long, however, financial aspect is an important factor from this

list. When financial resources of clients start draining, the problems of payments start rising. These problems add to the time delay and project deadlines are consequently not met [1].

Clients based changes can take different shapes. For example, alteration in size of project may require more material and more time to complete projects. Similarly, consultant changes may require time to fit in with the existing structure and hence time to complete the projects is lost.

Delay and Litigation

This hypothesis examines the impact of construction project delay on litigation issues. The relationship is found to be significantly positive. This means, that construction delays has significant positive impact on number of litigation issues faced by the construction company. The statistics for the relationship shows that p-value is 0.01 and β -value is 0.67 lead us to accept the hypothesis 3. A 1% change in construction delay causes 67% litigation incidences. An occurrence of litigation incident causes many factors to turn unfavorable for timely completion of project. The court may order against the project or change characteristics of the project. In this way a whole lot of time will be lost.

There are relatively scares studies that relate project delays with litigation incidences. A ranking of factors causing delay in project completion by [3] reveals that litigation is relatively less important for such cause. An analogous study for Malaysian construction industry shows that project delays are related to litigation incidents [2]. Accordingly, consultant related and contractor related factors are responsible for effects of delay and causing litigation charges [5].

The consequences for actions that trigger litigation are always deleterious. The court may levy a fine or order the cancellation of the project or any other penalty, which increases cost or extends the timeline. The court cases are ranked at number four ($RIR = 0.363$), in a research ranking factors that are causing delay in construction project completion [1]. Further he reported that the no or late payment for the completed work, change orders etc. are the main reasons for litigation.

The outcomes of litigation are never favorable because in every case some precious time is always lost. What makes things complex is the court system of country. With lesser courts and more cases on hand, the court proceedings are slow. Therefore, the construction companies cannot take the risk of getting tangled into litigations.

Delay and Abandonment

The last hypothesis of the study examines the relationship between “Delay in construction” and “Abandonment”. The relationship is found to be positive with delay in construction projects causing positive impact on abandonment of projects. The significance value is 0.01 and regression weight is 0.31. The strength of relationship is moderately positive. These values ($p=0.01$, $\beta=0.31$) indicate that the hypothesis 4 is statistically accepted at 99% level of confidence.

The effect of abandonment is never desirable for the construction firms because so much has already been put to use and a lot of effort has already been made. Research reports that consultant and contractor related factors lead to total project abandonment [5]. Similarly, total abandonment is ranked at number 4 in the overall effects of delay with RII value 0.456 [15].

A smooth flow of project towards its completion requires a steady injection of money in all stages of the project. However, in times during which companies are not able to ensure a steady flow of funds in project, the turbulence starts. Lack of financial means to support a construction project always causes difficulties and can be a factor for project abandonment [2]. Pakistan’s construction industry is no exception to the effects of delay on abandonment. In Pakistan, the construction industry faces project abandonment because of many withering financial means [1].

Construction industry in other parts of the world is not immune the negativities of construction project delays and project abandonments. For example researcher find that construction projects delays cause many of these projects to be abandonments in Nigeria [3]. In Pakistan, the main reasons for abandonment are the organizational changes, change in rules and regulations, financial crisis and natural disasters [1].

5. CONCLUSION:

The objective of the present study was to measure the effects of project delay like cost-overflow, time-overflow, litigation and project abandonment. Data on the study variables has been collected through structured questionnaire from 37 construction firms located in Punjab province of Pakistan. Participants were approached personally to collect the data. Various statistical tools such as reliability test, factor analysis, common method variance, normality test, and correlation, computation of means and standard deviations and structural equation model have been applied

for data analysis and inference. To the best of our knowledge, this study is pioneering in the area of construction project management as neither any international nor Pakistani research applied such data analysis techniques previously, to measure causes and effects of delay in construction projects. Thus, the present study is one step ahead in this line of research by proving intensity of cause and effects of construction delay through analysis of cause and effect relationship.

The objective of the study, the effects of delay in construction projects has been achieved successfully as the study found delay in construction projects leading significantly to the cost-overflow, time-overflow, litigation and abandonment that is highly unfavorable for the construction firms. Apart from that, the level of delay in construction projects has also been measured in various construction firms.

The study also answered the research question i.e. “how to avoid project delay and their after effects in construction industry of Pakistan?” The current study provides significant insights to the construction firms and they can formulate strategies to address the delay and its effects in construction projects. Moreover, Cost-overflow, time-overflow, litigation and project abandonment are the indirect outcome of causes of construction projects as discussed above. Since the agreement of projects, it is recommended that the firm should decide how to deal delaying factors to address the issues of extra cost and time, courts cases and abandonment of the construction project. To overcome these negative consequences construction firms should give significant amount of consideration to the causes of delay in construction projects. Through addressing these delaying factors, construction firm can avoid extra cost and ensure their profitability. Moreover, firm should avoid court cases, and solve them immediately once they happen.

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