

Causes of Delay in Construction Projects in Bangladesh

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Abstract: Construction delay is a common problem worldwide, which is considered as one of the main reasons for project failure. Bangladesh construction industry is no exception. This study investigated the main causes of delay in large building construction projects in Bangladesh. A questionnaire survey was conducted to determine the causes of delay from owners, consultants, and contractors of large building construction projects. About 70 respondents participated in the survey. Using the importance index analysis, the study identified 10 most important causes of delay from a list of 30 different causes. Ten most important causes were: (1) lack of experienced construction manager, (2) lowest bidder selection, (3) funding shortage by owner, (4) lack of proper management, (5) improper planning and scheduling, (6) lack of skilled workers, (7) site constraints, (8) contractors' cash flow problems during construction, (9) escalation of resources price, and (10) contractors' excessive workload. Furthermore, Kruskal-Wallis test indicates that there is no significant variation exists among the three group of respondents, ie owners, consultants and contractors.

Keywords: Construction Delay, Bangladesh, Developing Countries, Important Index

I. INTRODUCTION

Construction project delay can be defined by as “the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project” [1]. It has significant consequences as it would affect project performance [2]. For project owners, delay means loss of revenue; as for contractors it means loss of money [3]. Delay also creates caustic situation between owner and contractor such as dispute, ligation, arbitration, and some time total abandonment of the project [3; 4; 5].

Bangladesh is a developing country with high investment in construction industry, particularly commercial, residential, and multipurpose building projects etc., Almost 2.4 million people are working in this industry, which contributes about 20% to the national GDP [6]. Delay in delivering projects has serious drawback in this industry [3]. However, very few researches have been conducted to analyze the causes of delay in construction projects in Bangladesh. Salam et al. [7] studied the causes of delay, but focused in residential projects in Bangladesh. Ahsan and Gunawan [8] focused on identifying the factors of time and cost performance in infrastructure development projects funded by Asian Development Bank (ADB) in several Asian countries including Bangladesh. Therefore, this paper aims to identify the causes of delay of building construction projects in Bangladesh, and the important causes of delay in large building projects.

II. LITERATURE REVIEW

Construction industry is a multi-party business and numerous complexities turned it high-risk trade sector [9]. This industry deals with various contract documents to ensure all parties agreement.

The attributes of construction delay are well known but its fundamental factors and subsequent impacts are not understood by the experts. For this reason, many construction projects in different parts of the world are suffering by schedule overrun which subsequently increases the project cost and reduces profit [9; 10; 11]. Delay may start from feasibility study and end by the delivery of the project. The key players, ie owner, A/E or consultant, and contractor, are involved in schedule overrun of construction projects [1; 12; 13; 14].

Study by Assaf and Al-Hejji [1] identified 73 causes of delay in construction project of the Eastern Province of Saudi Arabia. They include: shortage of labors, unqualified work-force, inadequate contractor's experience, difficulties in financing project by contractor, ineffective planning and scheduling of project by contractor, low productivity of labors, delay in progress payments by owner etc. are noteworthy. Another study by Fugar and Ayakwah-baah [15] identified 32 factors of delay in building construction projects in Ghana. They include: monthly payments difficulties, poor estimation of project time and cost, incompetent site management, material shortage etc. ere Study by Long et al. [16] on large construction projects in Vietnam identified 62 causes of delay, which were grouped into four categories, ie organizational, project attributes, coordination, and environmental”. Study by Mohammed and Isah [17] on the causes of delay in construction projects in Nigeria identified 43 causes of delay frequently encountered in Nigerian construction industry. Among those, inappropriate planning, lack of communication, errors in design, shortage of resources supply etc. were top ranked factors, to lengthen the project schedule.

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After reviewing various literatures, this study identified 109 causes of delay, which are group into nine major factors: financial; owner; contactor; consultant; manpower and resources; project; managerial; rules and regulation; and environment.

III. RESEARCH METHODOLOGY

This study reviewed a good of articles on causes of delay in construction projects published in various technical journals. Based on the literature review, a survey questionnaire was designed for this study. The questionnaire had two measures, ie frequency and severity of the causes of delay. Both frequency and severity were defined in various categories by 1 to 4 point scale. In frequency, respondents were asked whether the factor of delay is found in rare, sometimes, often, or always, which are related to 1, 2, 3, and 4 respectively. On the other hand, severity of the delay factors also asked to the respondents in terms of little, moderate, great, or extreme and the point scale is similar to that of frequency (i.e. 1 to 4).

For this study, Sylhet, the north eastern part of Bangladesh was selected as the study area where the trend of population growth is very high (i.e. 8.25%) and 41% buildings have been constructed in last 10 years [18]. Accordingly, the construction rate of building projects in Sylhet region is very high and it needs greater concern about the construction management system. Approximately 45 consultants or A/E firms, and 100 contactors (all categories) are working for design, and construction of building projects in Sylhet (reported by Public Works Department, Sylhet, Bangladesh). Among first class, second class, and third class contractors according to their organization size and funding capacity, only the first class contractors who have 5 years or more experience to develop large buildings, were consulted for this interview survey. The survey was conducted with 20 professional consultants and 30 contractors. The list of developers/owners was not found in the corresponding government offices. 20 owners were interviewed for this study, where many of them are repeated builders and few of them are first time builders. Since the survey was carried out among the sample of the respondents, thus, it is necessary to check the sample size whether it is statistically sufficient to take inference.

A pilot survey was conducted by taking interview with 10 experienced engineers to select most relevant causes of delay in Bangladeshi construction projects. Following the pilot survey, some factors were deleted and few were added. Finally, a new questionnaire consists of 79 factors of delay was developed for the survey.

A. Data analysis

The data were analyzed by four methods, which are ranking and categorizing of the causes of delay by frequency and severity indices; classifying the importance of the causes by color matrix; establishing the relationship

among the parties by Spearman's rank correlation; and analyzing the variance of responses by Kruskal-Wallis test.

Ranking and categorizing of the causes of delay were performed with the equations used by Assaf and Al-Hejji [1] which was conducted to find the causes of delay in Saudi Arabian construction projects. The following equations calculate frequency index (FI), and severity index (SI) of each factor of delay:

$$\text{Frequency Index (\%)} = \sum a \left(\frac{n}{N} \right) * 100/4 \quad (1)$$

$$\text{Severity Index (\%)} = \sum a \left(\frac{n}{N} \right) * 100/4 \quad (2)$$

Where, 'a' is the weight (i.e. 1, 2, 3 or 4) of any response, 'n' is the number of respondents, and 'N' is the total number of responses in regards of frequency of the individual factor of delay. Based on the frequency index and its range shown in table 1, each factor was then ranked.

Table 1 Category of frequency and severity of occurrence of delay

Index Level (%)	Frequency	Severity	Color
≤ 25	Rare (R)	Low (L)	Green
≥ 25 to ≤ 50	Sometimes (S)	Medium (M)	Blue
≥ 50 to ≤ 75	Often (O)	Great (G)	Yellow
≥ 75 to 100	Always (A)	Extreme (E)	Red

The different level of frequency and severity were marked by color to produce various color zones for identifying the importance of the factors of delay. Figure 1 shows the color map which is produced by the combination of the category of frequency and severity of specific factor to define its importance level of delay. This color matrix was formed based on the concept developed by Mahmid [19]. If the factor falls in the red, yellow, blue, or green zone, it means the factor is very high, high, medium, or low, respectively in terms of importance, to cause schedule overrun.

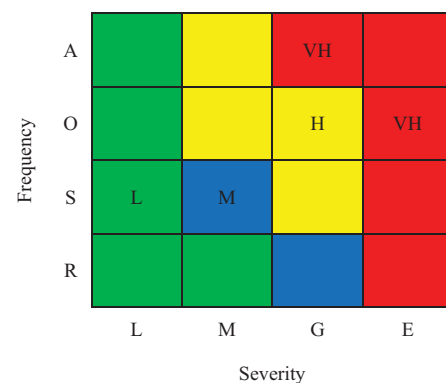


Figure 1 Color Matrix for classifying level of Importance of Delay Factors

Kruskal-Wallis test is applied to test the difference of responses among the three group of respondents.

IV. RESULTS

Out of 20 owners, 9 have less than five years, 9 have 5 to 10 years and 2 have 10 or more years of experience. Among 20 engineers, 3 of them have less than 5 years, 6 have 5 to 10 years and 11 have 10 years of experience to work as consultants in construction industry. Most of the respondents of contractor group were very much experienced. 18 contractors have been working 10 or more years, and the others have been working 5 to 10 years in this field. Thus, among the interviewed persons, contractors are more experienced than other parties. Working experience particularly in large building projects was the main focus of this study.

A. Frequent Causes of Schedule Delay

From 79 factors were selected for the survey, 7 factors were not answered by more than 70% respondents. For this reason, those 7 factors are deleted from further analyses. Thus, total 72 factors first ranked based on the calculated frequency index (FI), and then categorized by the index scale mentioned in the methodology. Top most frequent causes of delay are enlisted in the table 2.

Table 2 Top frequent causes of delay by all parties

Rank	Owner	Contractor	Engineers
1	Lack of experience construction manager	Lack of experience construction manager	Lack of experience construction manager
2	Building permits approval process	Interference in owner's decisions	Lowest bidder selection
3	Safety rules	Lowest bidder selection	Poor site management by contractor
4	Inaccurate cost estimation	Lack of proper management	Very poor consultancy fee
5	Lowest bidder selection	Contractor's cash flow problem during construction	Lack of modern equipment
6	Site constraints	Site constraints	Building permits approval process
7	Improper planning and scheduling	Very poor consultancy fee	Safety rules
8	Lack of database for estimating activity duration and resources	Lack of modern equipment in national market	Lack of proper management
9	Escalation of resources price	Contractor's excessive workload	Improper progress monitoring and cost control
10	Contractor's excessive workload	Obtaining permits from municipality	Lack of skilled workers

It can be seen in Table 2, the three groups of respondents agreed that lack of experienced construction manager and lowest bidder selections are always (i.e. FI >75) encountered cause of delay. All respondents have also the same opinion about managerial issues, which are recognized as very high occurrence causes of delay. For

example, contractor's excessive workload, lack of proper management, poor site management by contractor etc. are managerial problems, which are found in the top list of frequent causes according to the three groups of respondents. They have also identified building permits and approval process from government offices as one of the most frequent causes of delay. Owners and engineers identified violating safety rules as the other "always frequent" causes of delay. Owners and contractors identified that few financial factors are mostly responsible for delay. For instance, they emphasized on escalation of resource price, and interference in owners' decision as often frequent ($50 \leq FI \leq 75$) factors of delay.

The outcomes of some previous studies about schedule delay in different parts of the world were similar to Bangladesh. Long et al. [16] discovered that lack of experience construction manager, site constraints, and fluctuation in material prices were most frequent causes of construction delay in Vietnam. Furthermore, Yau and Yang [20] discovered building permits and approval process as one of the most frequent causes of delay in Taiwan. While, Assaf and Al-Hejji [1] found that improper planning and scheduling; contractors' cash flow problem during construction; and lack of skilled worker were always frequent causes of delay by owner, contractor, and engineer respectively.

Table 3 Frequency ranking of group causes based on different categories of respondents

Group Factor	Category (Rank)			
	Owner	Engineer	Contractor	All
Rules and Regulation	Often (1)	Often (2)	Often (2)	Often (1)
Contractor	Often (2)	Often (1)	Often (5)	Often (2)
Managerial	Often (3)	Often (3)	Often (4)	Often (4)
Financing	Often (4)	Often (5)	Often (1)	Often (5)
Owner	Often (5)	Often (4)	Often (3)	Often (3)
Project	Often (6)	Often (6)	Often (6)	Often (6)
Consultant	Some-times (7)	Often (9)	Some-times (8)	Often (8)
Manpower and resources	Some-times (8)	Often (8)	Often (7)	Often (7)
Environmental	Some-times (9)	Often (7)	Some-times (9)	Some-times (9)

The study also identified most frequent group causes of delay based on frequency index (FI) which is simply the average of FI of individual causes in each group. The order of group causes along with FI and categories of frequency is presented in the table 3. According to owners and all respondents, rules and regulation group is ranked first most and defined as 'often frequent' factor of delay. On the other hand, engineers, and contractors selected contractor, and financial group factors successively as top frequent group causes of delay. It is noticed that among 9 groups, almost 7 factor groups are classified as often frequent to delay the project. In addition, environmental and consultant

groups are recognized as less important factors of delay. Similar to our study, a recent study on construction delay in Pakistan revealed that financial issue is the number one group factor of delay based on contractors' view [21].

B. Severe Causes of Delay

This study also identified the severity of the causes of delay based on the judgment of each group of respondents. The most severe causes of delay by three parties are shown in table 4. All groups of respondents identified that fund shortage by owner, lowest bidder selection, and lack of experience construction manager are extremely severe (SI>75) to inflate construction schedule. In addition, owners and engineers identified some other most severe causes of delay such as inaccurate cost estimation, lack of experience, improper planning and scheduling, improper progress monitoring and cost control etc. On the other hand, both contractors and engineers acknowledged that improper feasibility is one of the great severe causes (SI=70 app.) of delay, which is usually overlooked by owners in pre-construction phase. Moreover, contractors identified some different factors for instance, interference in owners' decisions for funding, contractors' excessive workload, site constraints etc. as extreme/great severe causes of delay. However, owners and engineers have different views for these factors.

Table 4 Most sever causes of delay by different respondents

Rank	Top factors by		
	owner	contractor	engineers
1	Inaccurate cost estimation	Funding shortage by owner	Funding shortage by owner
2	Funding shortage by owner	Interference in owner's decisions	Lack of experience construction manager
3	Transportation problem	Lack of experience construction manager	Lowest bidder selection
4	Lowest bidder selection	Lack of modern equipment in national market	Lack of skilled workers
5	Obsolete (old) construction methods and technologies to site investigation	Improper feasibility study	Lack of proper management
6	Lack of experience	Lowest bidder selection	Improper planning and scheduling
7	Lack of constructability	Contractor's cash flow problem during construction	Improper progress monitoring and cost control
8	Lack of experience construction manager	Contract related disputes/claim	Very poor consultancy fee
9	Escalation of resources price	Contractor's excessive workload	Improper feasibility study
10	Improper planning and scheduling	Site constraints	Poor site management by contractor

Studies in Vietnam, Malaysia, and Saudi Arabia have some similar findings to this study. Long et al. [16] pointed out fund shortage by owner, lack of experience

construction manager, contractors' excessive workload, site constraints, and contract related claim/dispute as severe causes of delay in Vietnam construction projects. Fund shortage of owner and lack of experience construction manager were identified as significant causes of delay by construction project owners in Malaysia [14]. Furthermore, the same study revealed that Malaysian contractors' also identified lack of experience construction manager, fund shortage by owner, and interference in owners' decision as extremely severe causes of delay, which are similar to the condition of construction projects in Bangladesh. Owners in Saudi Arabia identified that contractors' lack of experience, improper planning and schedule are the most severe causes of construction delay. However, A/Es (consultants) indicated that lack of skilled worker, and poor site management by contractor are the most severe causes of delay in Saudi Arabia ([1]).

Table 5 shows the severity indices of group causes of delay along with the category of severity and arranged the groups in order. All the parties unanimously answered that each group is great severe to delay the project. Both owners and engineers stated that contractor group is the most leading cause of delay. Contractors argued the opinion of owners and engineers, and they selected "financing" as the highest factor group and similar result is found by all respondents' data investigation. Regarding managerial factors, all stakeholders of construction industry have consistent opinion and marked this group as one of the high responsive causes of delay. However, Marzouk and El-Rasas[22], who conducted similar study in Egypt, discovered owner related causes as enormously significant for schedule overrun followed by contractor issues.

Table 6 Top ten frequent, severe and important causes of delay by all respondents

No.	Individual factors	Frequency Level	Severity Level	Color zone	Category of importance
1	Funding shortage by owner	Often	Extreme	Red	Very high
2	Lack of experience construction manager	Always	Extreme	Red	Very high
3	Lowest bidder selection	Often	Extreme	Red	Very high
4	Lack of skilled workers	Often	Great	Yellow	High
5	Lack of proper management	Often	Great	Yellow	High
6	Improper planning and scheduling	Often	Great	Yellow	High
7	Contractor's cash flow problem during construction	Often	Great	Yellow	High
8	Escalation of resources price	Often	Great	Yellow	High
9	Site constraints	Often	Great	Yellow	High
10	Contractor's excessive workload	Often	Great	Yellow	High

B. Kruskal-Wallis test

A hypothesis test (i.e. the null hypothesis indicates no significant difference exists and alternate hypothesis represents a significant difference exists among the three parties in response of factors of construction delay) was performed with the aid of Kruskal-Wallis test. In general, null hypothesis is accepted for most of the causes, which means no significance difference exists among the responses of different parties. But the level of confidence to conclude about the relationship is very poor. Very few causes like fluctuation in material price, modern equipment in national market, lack of feasibility study, lack of experience construction manager, project site clearance, unskilled operator/technical person, equipment failure etc. have found approximately same mean by all the parties and confidence level also achieved to 95%.

V. CONCLUSION

This study focused on the construction delay of large building projects in Bangladesh. Three major parties of the projects: as owner, consultant, and contractor were asked to find the most important causes of delay. 79 factors were discovered as important causes of delay in building construction projects. Among those factors, all parties agreed that lack of experience construction manager, lowest bidder selection, fund shortage by owner, project site constraints, improper planning and scheduling, contractor's excessive workload, lack of proper management by both owner and contractor especially poor site management by contractor, lack of skilled workers, site constraints, contractor's cash flow problem during construction, escalation of resources price, contractor's excessive workload etc. are the most important causes of delay. These causes are mostly related with managerial and financial issues, which are similar to condition in some other developing countries, such as: Pakistan, Vietnam, Egypt and Saudi Arabia. There is no significance variance among the parties in their responses on the most important causes of delay.

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