Analysis of Cost and Schedule Performance of Public Sector Infrastructure Projects of Bangladesh

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Abstract

Projects completed beyond its stipulated time and budget is a chronic problem in public sector infrastructural project of Bangladesh. The present study aims to know the average time and cost overrun including identifying significant factors encountered for delay and cost escalation. Data from 92 completed projects in FY 2016-17 were collected from the annual reports of Implementation Monitoring and Evaluation Division (IMED) of four selected executing agencies responsible for infrastructuredevelopment in Bangladesh. Considering COVID-19 pandemic, data were also collected through phone interview from 20 selected experts involving the major project stakeholders such as consultants, contractors and project management's team of implementing agencies. The study found that completed infrastructural projects experienced both cost and time overrun by 38.45% and 90.47% respectively. Projects were implemented under 4.7 numbers of Project directors on average. The time overrun of a project is positively correlated with the number of Project Directors worked in a project with Pearson Correlation Coefficient of 0.268** (n= 92) at .01 level of significance. Delay in land acquisition and change of design and schedules of rates were the prominent causes for cost escalation. On the other hand, Complexity in land acquisition procedure and lack of proper coordination among the parties contributed greatly for schedule delays in construction project. Lack of institutional capacity of implementing agencies to implement the project, natural disasters, designchanges, project approval and implementation without having complete feasibility study also hamper on time project completion. Although there are no straightforward solutions, estimating justified project scheduling with clear scope definition preferably through feasibility study would lessen the necessity of project revision. Strong coordination among various parties and effective communication among the stakeholders are vital at implementation stage. Systematic HRM especially recruitment and transfer of project personnel, development of project management competency and strengthening government ME system through decentralization would be effective for implementation and monitoring and thereby improving project success in terms cost and schedule. The findings of this study will assist project managers and practitioners to control any potential delaysfor successful completion projects within the stipulated budget.

Keywords: *Cost overrun, time overrun,project management.*

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1. Introduction

Public sector development projects have been specifically designed for meeting economic and social needs. The goal of these projects mainly concern with poverty alleviation and improvement of living standards along with development of basic physical and social infrastructures. As part of the commitment of the present government to become a developed nation by 2041, various projects under public finance

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are implementing in line with the Five Year Plan (FYP) and Perspective Plan as formulated by the government. In FY 2020-2021, about 1606 nos. of development project has included in Annual Development Program (ADP) with an allocation of BDT 214,611.09 Crore (Planning Commission, 2020).

Project is a set of activities, which have been undertaken to create an outcome in a definite period of time within the defined scope, cost and desired quality. A project is successful when it is completed on time, within the budget with a quality outcome to satisfy the need of the stakeholders. Most of construction projects suffer delays. The effects of these delays may be of considerable magnitude on the efficiency of the project. It is possible to reduce these delays through recognition of their real causes. Definitions of delays in construction can be presented in several ways. Non- Excusable delays is due to contractor or its suppliers and who entitled to accelerate their work done in estimated time are to pay compensation to the owner. The contractor compensates on the basis either on liquidated damages or actual damages, provided that there is no section of liquidated damages in the contact. Liquated damages base on the daily rate of estimated costs which is likely to incur in the delay of construction projects of the owner by the contractor.Excusable delaysare two kinds. Non-compensable delays are not caused by the owner and the contractor rather it is acted by third party like natural calamity, strikes, fires etc. Due to this, the contractor gets extension in time and does not pay any compensation for delay damages. Compensable delays are not caused by the third party but it is acted by the owner or the owner's agents. An example of non-completion of drawings in the required time by a client leads to the extension of the schedule and it imposes economic damages to the owner by the contractor.

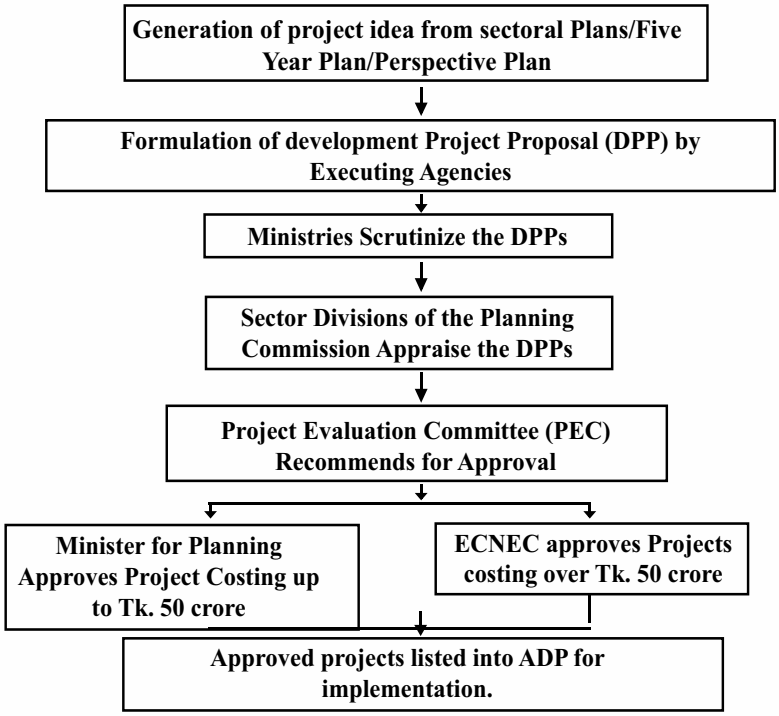
Project completion within time and costand maintaining quality throughout are key success factors mentioned by project management professional bodies and the research community. Time and cost performance studies have been conducted for several developing countries and for different types of projects. Literature identifies development projects as well-known for over-running cost and schedule budgets. Kaka and Price (1995) and Chan (2001) attempt to build an empirical relationship between time and cost performance and predict construction time is a function of cost. A research work carried out by Sambasivanet. al. (2007) reveals six effects of delay on project performance in Nigeria which are time and cost overruns, disputes, arbitration, litigation and total abandonment.

Project Implementation delays occur in most construction projects and the magnitude of these delays varies considerably from project to project. This inability to complete projects on time continues to be a chronic problem in Bangladesh. Each year Implementation Monitoring and Evaluation Division (IMED), Ministry of Planning compiled completion reports and found significant delays and escalation of cost in most of the project. The purpose of this paper is to critically assess these overrun and identify the factors causing cost and time overrun in infrastructural projects in Bangladesh.

1.1 Projects Initiation and Approval Process in Bangladesh

Development projects Processing for approval involves several steps. At the formation stage, a project may be an idea with preliminary studies of its desirability in terms of national needs, and likely cost and benefits. At this stage, it has to be spelled out in greater details and specific terms in order to enable the decision making bodies to evaluate it and to approve (or postpone or reject) it. Broadly, after formulation of development project proposal (DPP) by executing agencies, concerned ministries scrutinize the DPPs, and then Sector Divisions of the Planning Commission appraise the DPPs. This is followed by recommendation for approval by the Project Evaluation Committee (PEC). Then the Minister for Planning or the Executive Committee of National Economic Council (ECNEC) approves the project depending on the size of the project, after which the approved projects are included in ADP for implementation.

Steps involvoed in Investment Projects Processing / Approval Process



1.2 Schedule Delays and Cost Overrun

Schedule delay refers to a situation where a project does not finish within the planned period. There are two kinds of delay, excusable and non-excusable. There is a relationship between the schedule, the scope of work, and project conditions. Changes to any one or more of the above three can affect the compensation level and time of completion. Mansfield et al. (1994) showed that the most significant factors affecting construction schedules were financing and payment for completed works, poor contract management, changes in site conditions, shortage of materials, and improper planning. Ahmed et al. (2002), Al-Moumani (2000), and Assaf et al. (1995) agreed on most of the causes of schedule delays and concluded that the most significant causes of delay included approval of working drawings, delays in payments to contractors and the resulting cash-flow problems during construction, design changes, conflicts in work schedules of subcontractors, slow decision making and executive bureaucracy in the clients' organisations, design errors, labor shortage and inadequate labor skills.

Cost escalation refers to the increase in the amount of money required to construct a project over and above the original budgeted amount. Datta(2002) described cost escalation as a ubiquitous problem in government projects which occurs when actual costs exceed previously estimated values.

1.3 Significance of the study

The present study will have a great contribution to the field of project management which could guide project executing agencies, contractors and consultants to address the challenges facing the infrastructure

project in a timely manner. It would also guide the initiative for future studies in the area of project management and construction field.

1.4 Objectives

1. To What extent project schedule and cost are overrun in completed infrastructural Projects?

2. What are the significant factors that are causing delay in construction projects and its effects in Bangladesh?

3. What are the applicable solutions to minimize the causes of delay in construction projects in Bangladesh?

2. Methodology

The scope of the research generally concentrates on literature review and analysis of secondary data. Quantitative data was collected from annual reports of IMED for infrastructural project completed on Financial Year 2016-2017. Based on the availability of Schedule and Cost related data, 92 projects were studied out of 98 projects completed in FY 2016-17 by Roads and Highways Department (RHD), Power Division (PD), Local Government Engineering Division (LGED) and Public Works Department (PWD) mainly responsible for infrastructural development in Bangladesh. The distribution of the projects according to implementing agencies is as follows:

Agency	**Number of Projects Studied**
Roads and Highways Department (RHD)	49
Power Division (PD)	8
Local Government Engineering Division (LGED)	17
Public Works Department (PWD)	18
Total	**92**

Considering currentcovid-19 pandemic situation, greater insights on project cost and schedule management were collected from three important project stakeholders through phoned interview such as 1) ProjectDirectors or Mangers/Project Engineers, 2) IMED Officials 3) Contractors/Suppliers. Distribution of phone interviewed respondents is as follows:

Category	Number of respondents
Project Directors/Deputy Project Directors	10
IMED Officials	05
Contractor/Suppliers	05

Collected data have been cleaned, edited, arranged and coded before statistical analysis. The analysis was performed by using SPSS 17. The correlation between time overrun and cost overrun and with number of project directors were carried out to find the relationship and measure the strength.

Agency	Number of Projects Studied	Average Cost Overrun (%)	Average Time Overrun (%)	No. of Project Directors
RHD	49	36.59	74.46	5.37
PD	8	1.77	65.83	4.63
LGED	17	40.36	65.5	3
PWD	18	58.04	168.59	4.94
Mean	**Total =92**	**38.45**	**90.47**	**4.78**

3. Results and Discussion

The schedule and cost performance of the completed projects is presented below:

Table.1 Schedule and cost performance of the completed projects in 2016-2017

3.1 Cost Performance

The result of the study showed that, in FY 2016-2017, projects had been completed with 38.45% higher costs than originally estimated. projects completed by PWD hadencountered the highest average cost overrun of 58.04% followed by LGED, RHD and PD. On the other hand, escalation of project cost was minimal for power sector projects and found efficient in term of cost performance in FY 2016-2017. Accurate cost estimation at planning stage might be attributed to the minimal cost overrun for PD Projects.

3.2 Schedule Performance

The study showed projects had required 90.47% more time to complete on average**.** PWD Projects has taken longer implementation period. The average time overrun for PWD Project was 168.59% showing the poorest schedule performance among the selected agencies. Complexity and increase of land acquisition cost during execution period might be the cause for time overrun. Projects of PD and LGED performed better in terms of average amount of time taken to complete project.

3.3 Numbers of Project Directors

On average 4.78 numbers of project directors served in each project to complete. RHD appointed the highest number of project directors to complete a project in its estimated duration. Result showed that 5.37 numbers of project directors had been involved in managing a single project. In contrast, LGED only deputed 03 numbers of Project directors to complete a project. Changing project directors during implementation can interrupt smooth implementation and loss of acquired project management knowledge during the course of implementation. The finding highlighted the ignorance of the circular issued by the Ministry of Planning regarding appointment of full time project directors for projects having cost more than BDT 50 crore.

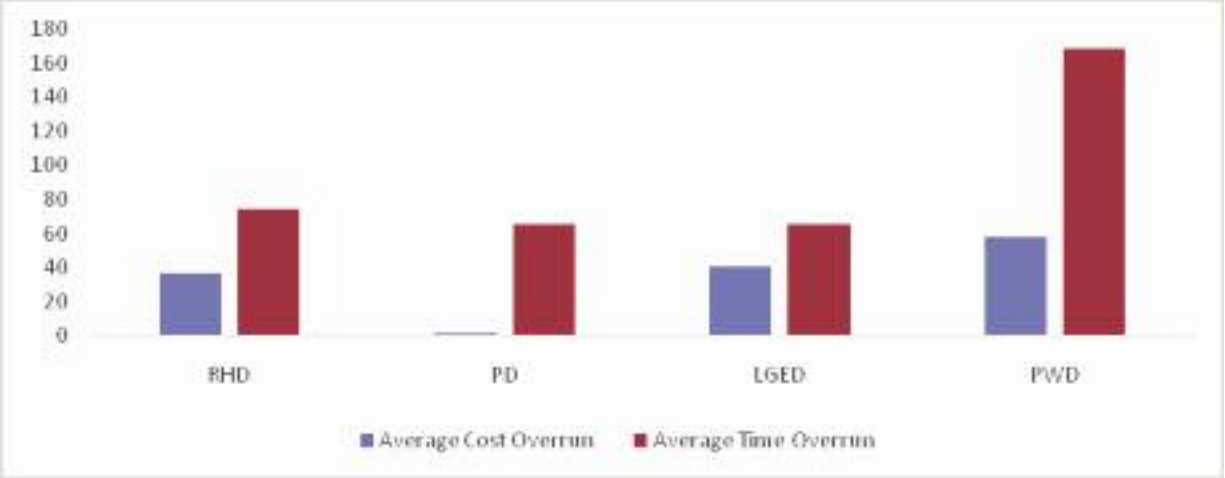


Fig. Cost and Schedule Performance of Completed Infrastructural Projects in 2016-17

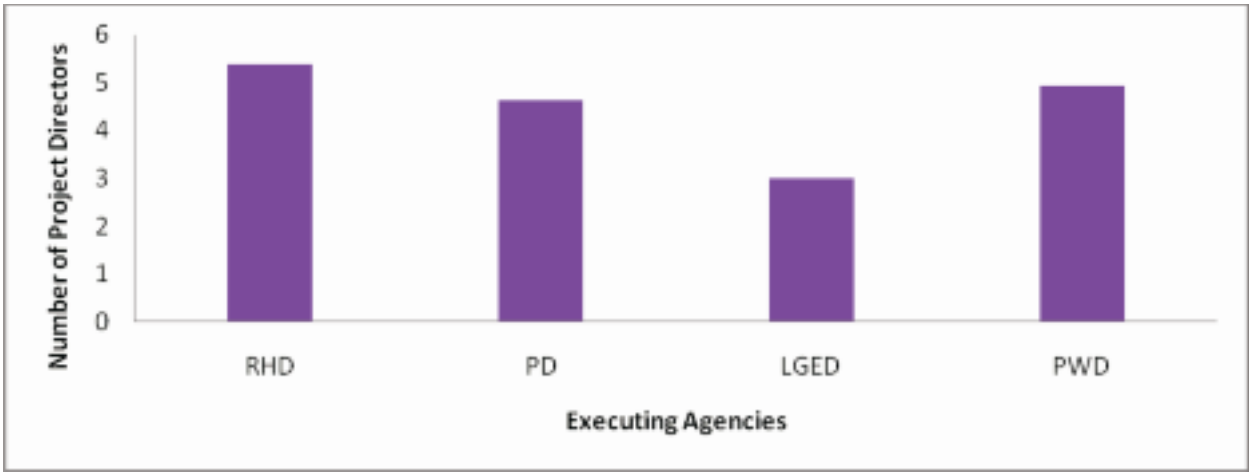


Fig. Average number of Project Directors engaged to complete an Infrastructural Projects in 2016-17

Table 2 Relationship between the Number of Project Director engaged in completing a Project and Schedule and Cost performance of Completed Project

		Computed R value	
		Time overrun	Cost overrun
Number of Project Director engaged to complete a Project	Pearson Correlation	.268**	-.052
	Sig. (2-tailed)	.010	.623
	N	92	92

**. Correlation is significant at the 0.01 level (2-tailed)

The time overrun of a project is positively correlated with the number of Project Directors who worked in a project with Pearson Correlation coefficient of 0.268** (n= 92) at .01 level of significance.

3.4 Causes of delay and cost escalation

When asked about the significant reasons for project delays and cost escalation,respondents mentioned the following significant reasons.

Schedule Delay	Cost Escalation
Complexity in land acquisition	Increase of land acquisition cost
Lack of proper planning	Change of design
Change of tender rate, tender procedure after DPP approval	Change of schedules
	Escalation of material prices
Lack of institutional capacity of implementing agencies to implement the project	Poor quality of materials and unreliable suppliers/subcontractors
Natural disasters	Natural disasters like flood, rain etc.
Change of the design of major component	Delay in obtaining permits from respective authorities
Conflicts with sub-contractors	
Contractor's difficulties in financing	
Frequent design changes	
Slow decision making	
Poor coordination between parties of the project	

4. Conclusion and Recommendations

Despite substantial investment in infrastructure projects, improvements in the performance of the sector are significantly impeded by cost escalation and schedule delays experienced by many projects in Bangladesh. The study found that completed infrastructural projects experienced both cost and time overrun by 38.45% and 90.47% respectively. Projects were implemented under 4.7 numbers of Project directors on average. Delay in land acquisition and Change of design and schedules to be the prominent cause for cost escalation. It was followed by scope changes (addition and subtraction of new schemes), Change of tender rate, tender procedure after DPP approval, environmental protection and mitigation costs. Schedule delays, strikes, pressures, technical challenges and inflation were also found to be contributors to cost escalation. On the other hand, complexity in land acquisition procedure and lack of robust project plansgreatly affect project schedule.Lack of institutional capacity of implementing agencies to implement the project,natural disasters, change of the design of any component of the project, project approval and implementation without having complete feasibility study and poor communication and coordination between parties also contributed delays in project completion.

There are no straightforward solutions to the challenges of cost escalation and schedule delays in construction projects. There are, however, steps that can be taken to minimize their causes and effects, the major one being the use of efficient project management tools and practices. For the specific factors that cause cost escalation and schedule delays in construction projects in Bangladesh, the following recommendations are suggested:

Appointment and Transfer of Project Directors

Strict adherence to the circular issued by the Ministry of Planning regarding appointment of full time project directors for projects having cost more than BDT 50 crore should be maintained. Project personnel should not be transferred to other job areas unless required for public interest.

Project scheduling

The projects should be properly timed in such a way that most of the works can be executed in seasons of clement weather between early October and early May, which is the dry season in Bangladesh. This means that project procurements need to be completed on an appropriate time.

Scope definition

For all projects, scope needs to be well defined. Scope changes often lead to disruption of work which is a result of inadequate analysis at planning stages.Scope variations are more costly hence compound cost escalation. Scope should be defined by collecting requirements from all stakeholders possibly thorough a consultation meeting at planning stage or will have much effect in later implementation.

Project costing and financing

The initial cost estimates should be as realistic as possible. Cost and value engineering principles must be applied at all stages of the project. During the execution stage of the project, project managers should ensure that contractual obligations are dealt with diligently within the required period. Physical and price contingencies have to be proposed based on the possibility of inflation and amount of risk to be encountered.

Coordination and Communication

Effective coordination and communication among the project stakeholders can alleviate most of the factors that cause cost escalation and schedule delays in construction projects. Project managers ought to form a team of designated persons from each of the important agencies for the project and make a smooth communication processe among them. All project issues need to be dealt with objectively and ensure that all communication is project issue based.

Competent personnel

Clients, Consultants and Contractors should ensure that they have the right personnel with the right qualifications to manage their projects. Where possible, project managers need to have experience and qualifications in project or construction management so that they can effectively utilize the project management tools that are available.

Capacity building

Systematic capacity building on project management is essential for sustainable development. Deliberate policies for personnel having project management certification should be put in place by contractors, consultants and clients.

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