

Cost and Time Overruns in Highway Projects of Pakistan

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Abstract

Meeting project objectives like timely completion within allocated cost reflects good project management in any field. Construction Industry of Pakistan with a contribution of only 2.405% to GDP, suffers badly due to lack of investment in infrastructure sector like roads, rail etc and poor management of projects experiencing delays and cost overruns. In transport sector, national highway is vital trade route in Pakistan as it carries 80% of the country's commercial traffic, clearly indicating that it constitutes major component of construction industry. This study aims to investigate key factors causing cost and time overruns in highway projects through literature review and questionnaire survey. Factors like delay in progress payments to contractors, land acquisition process, price escalation of major construction materials, improper planning, contractor's incapability to do the job, delay in handing over the site to the contractor, additional work / scope changes and inappropriate government policies and priorities were identified by the study which severely affect the duration and cost of a highway project. Appropriate project management practices can help in minimizing the impacts of delays and cost overruns in highway projects.

Keywords

Cost Overruns, Time Overruns, Delays, Highway Projects, Pakistan.

1. Introduction

A project is considered successful if it is completed on time, within budget and to the specified quality standards (Frimpong. Y et al, 2002). Project Management as defined by Oberlender (2003) is the art and science of coordinating people, equipment, materials, money, and schedule to complete a specified project on time and within approved cost which clearly indicates that balancing the competing demands of cost within scheduled time are very essential to a project. Cost and time overruns are major problems faced by both developed and underdeveloped world, however their dynamics are quite different in both (Angelo and Reina, 2002). Cost and time overruns can occur due to variety of causes on various types of projects. If project costs or schedules exceed their planned targets, client satisfaction would be compromised and the resulting effects would be detrimental specially in the case of developing countries whose wealth measure is greatly dependant on their performance in infrastructure provision through the construction industry, especially on road construction projects which constitute a major component of the industry (Kaliba et al, 2008). This

problem is not exclusive for the developed world but is also experienced in most of the developing economies too. An e-paper (The Hindu, 2007) carried an article which indicated that construction projects in India were prone to delays and cost overruns, resulting in back out of contractors from some of the projects. According to (Ahmed et al, 2002), delays on construction projects are a universal phenomenon and road construction projects are no exception. They are usually accompanied by cost overruns. These have a debilitating effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of trepidation towards each other.

A wide range of studies have been made worldwide in order to evaluate factors that cause cost overruns and delays in construction projects, mainly focused on building projects. However, comparatively fewer studies have been carried out to assess these factors in roads / highways construction projects. In Pakistan, a number of studies were carried out to identify factors causing delays and cost overruns in construction projects. More or less all were focused on building projects or construction projects of all types, indicating a clear need to identify these factors specifically in roads / highways sector as none of the study has been recorded till date.

Pakistan suffers from a lack of infrastructure in the water, irrigation, power, and transport sectors; infrastructure, all of which are essential for sustained growth and competitiveness both in the local and international markets. The transport sector inefficiencies are costing the economy between 4-5 percent of GDP each year indicating the need for massive investment in roads, rail, air and ports (World Bank report, 2007). To overcome the deficiencies mentioned in World Bank's report, a high level of activities were carried out in road sector vide billion dollars loans from financial institutions like World Bank, Asian Development Bank etc (BMI's Report, 2008). Numerous projects of highways have been implemented and executed to increase the contribution of road sector to the GDP of country as almost 80% of the commercial traffic is dependent on national highways (National Highway Authority website). But unfortunately, objectives of timely completion within costs in highway projects of Pakistan are not achieved as the same delayed badly with exceeded costs. Several factors are responsible for these delays and cost overruns and few might be totally different from building projects.

As the (World Bank report, 2007) clearly indicated inefficiencies in transport sector, reduction in impacts of identified factors of this study may help in timely completion of highway projects within cost will definitely result in increment of construction industry's contribution in the Gross Domestic Product (GDP) of country.

2. Literature Review

1.2. Cost Overruns

Cost overrun can be simply defined as 'when the final cost of project exceeds original estimates' (Avots, 1983). United States General Accounting office in 1997, found that 77% of highway projects in the USA experienced cost escalation. Study of (Datta, 2002) depict that delays between the planning stage and actual implementation of especially large infrastructure projects is an ubiquitous problem resulting in cost and time overruns. Other studies (Mansfield et al, 1994 and Schexnayder et al, 2003) identified that cost overruns occur due to a result of problems such as delay in land acquisition, unexpected problems in supply of raw materials, illegal encroachment on land even during project implementation, or due to internal problems in government organizations. Bad or inclement weather, resulting from heavy rains and floods was found on the top list of factors causing cost overruns in road projects (Kaliba et al, 2008). A study undertaken to evaluate factors causing cost overruns in Ghanaian Road Construction Sector shows that delays in monthly payments to contractors, variations, inflation, schedule slippage and lack of project knowledge are the five most important factors agreed by major project participants i.e. clients, contractors and consultants (Nicholas and Paul, 2010). Inconsistent cash flow was the most significant factor causing delays in construction projects of Pakistan revealed by Nadir (2010).

1.3. Time Overruns

Time overrun refers to a condition where a construction project does not meet completion within the planned period (Daniel and Mohan, 1997). According to (Ahmed et al, 2002) delays can be grouped in the following four broad categories depending on how they operate contractually:

- Non-excusable delays;
- Non-compensable excusable delays;
- Compensable excusable delays; and
- Concurrent delays.

Odeyinka and Yusuf (1997) show that seven out of ten projects in their study suffered delays in their execution. (Daniel and Mohan, 1997) came up with a conclusion that poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, clients-initiated variations and necessary variations of work are five significant causes of delays in construction projects. Contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work and problems with subcontractors were factors evaluated in Malaysian construction industry (Murali and Yau, 2007). Important causes of delay identified by (Mansfield et al. 1994) are: financing and payment for completed works, poor contract management, changes in site condition and shortages in materials. (Odeyinka and Yusuf, 1997) classified the causes of delay via project participants and extraneous factors. Client-related delays identified include variation orders, slow decision-making and cash flow problems while contractor-related delays include 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, labour disputes and strikes (Aibinu and Jagboro, 2002).

3. Research Scope and Objectives

The research study was focused on recently completed and ongoing Highway projects, under the umbrella of federal and provincial authorities of Pakistan. The main objectives of the study were to;

- Identify certain key factors responsible for delays and cost overruns in highway projects of Pakistan from detailed literature review and inputs from experienced professionals of construction industry.
- Rank the factor identified through research in light of the response obtained in the questionnaire survey.
- Discuss major reasons causing certain delays and cost escalation, which may help in reducing their impacts on future projects.

4. Research Methodology

To obtain the desired objective, following methodology was used:

1. From detailed literature review and inputs from experienced professionals of road construction sector of Pakistan, factors of cost and time overruns were identified separately. In total, twenty eight (28) cost overrun factors and thirty (30) delay factors were short listed.
2. The questionnaire was designed to determine the major causes of cost & time overruns in highway projects and was divided into two (02) parts. First part was aimed at personal and organizational information of the respondent (for e.g. highest qualification, years of experience,

designation, volume of highway projects undertaken, firm's expertise). In second part, respondents of the questionnaire survey were asked to rate the causes of cost escalation and schedule overruns. In addition, respondents were also encouraged to cite additional factors thought to extend the construction durations of projects.

3. The rating of factors given by the respondents for cost and time overruns were used to rank the factors so as to obtain the construction industry's perspective of the main causes of cost escalation and delays. Participants of the questionnaire survey were asked to rate the causes of cost escalation and schedule overruns with respect to their significance level.
4. A total of fifty (50) questionnaires were floated to major project participants i.e. (28) construction contracting and (22) consultancy firms only related to road construction sector through email and postal delivery. Out of these, a total of thirty seven (37) responses (74%) were received with an individual response rate of (67.8%) from contractors and (81.8%) from consultants.
5. Accordingly, factors were analyzed statistically from a total of thirty five responses (two being insufficient and were casted off). Analysis is discussed in detail in following section which may help in reducing the impacts identified factors on future projects.

5. Analysis and Discussion

The rating of factors given by the respondents for cost and time overruns were used to rank the factors so as to obtain the construction industry's perspective of the main causes of cost escalation and delays. Participants of the questionnaire survey rated the causes of cost escalation and schedule overruns with respect to their significance on a Likert scale ranging from 1 to 5, where 1 = not significant, 2 = slightly significant, 3 = moderately significant, 4 = very significant and 5 = highly significant.

The data was analyzed using the 'relative importance index' as used by (Kometa et al). The method was adopted for the analysis of the data collected from the current questionnaire survey, within various groups as classified. The five-point scale mentioned earlier was transformed to relative importance indices for each factor, using the above method, to determine the ranks of the different causes. The relative importance index (RII) was evaluated using the following expression:

$$\text{Relative importance index (RII)} = \sum w / (A \times N) \text{ --- , } (0 \leq \text{index} \leq 1)$$

where w = weighting given to each factor by the respondents and ranges from 1 to 5 where '1' is 'not significant' and '5' is 'extremely significant', A = highest weight (i.e. 5 in this case), and N = total number of respondents (i.e. in this case 35) .

Before asking to rate the given factors, every respondent was asked to mention the key factors responsible of increasing project cost and time. More or less all the mentioned factors were later found in the given list, indicating a comprehensive literature review and input from experienced professionals.

5.1. Major Causes of Cost Overruns

Cost overrun factors identified through the study have been ranked based on the rating of respondents. Top ten factors are shown in Table 1. Price escalation on major construction materials/ Price Adjustment came out as the leading cost overrun factor in highway projects of Pakistan through questionnaire survey with a highest relative importance index of 0.7871. This factor was followed by an emerging factor of land acquisition & resettlement and then by improper planning having RII value of 0.7613 and 0.7548 respectively. Inappropriate government policies & priorities scored 0.7484, while additional work and poor project (site) management / poor cost control by contractor scored

similar RII of 0.7419. The others factors were delay in decision making process by client, fraudulent practices / kickbacks / corruption, inadequate duration of contract period and Inaccurate quantity and cost estimation.

Table 1: Top Ten Cost Escalation Factors

| S. No | Factor | RII | Rank |
|-------|--|---------|------|
| i | Price escalation on major construction materials/ Price Adjustment | 0.7871 | 1 |
| ii | Land Acquisition & resettlement | 0.7613 | 2 |
| iii | Improper planning | 0.7548 | 3 |
| iv | Inappropriate government policies & priorities | 0.7484 | 4 |
| v | Additional Work | 0.7419* | 5 |
| vi | Poor cost control by contractor | 0.7419 | 6 |
| vii | Delay in decision by client | 0.7226 | 7 |
| viii | Fraudulent practices / kickbacks / corruption | 0.7097 | 8 |
| ix | Inadequate duration of contract period | 0.7032* | 9 |
| x | Inaccurate quantity and cost estimation | 0.7032 | 10 |

* Equal relative importance indices of the individual factors are ranked according to the percentage of respondents scoring highest rating i.e. 5 in this case

5.2. Discussion on Three Major Cost Overrun Factors

The major five cost overruns obtained through the study are discussed below;

- 5.2.1 Price escalation on major construction materials / Price adjustment contributes much in increasing the cost of a highway project. This increase in cost is attributable to be paid by the client in accordance with Pakistan Engineering Council's (PEC) price adjustment document (2009) and in accordance with FIDIC conditions of contract (editions of 1992, 1999, 2005 and 2006), whichever is applicable. The additional cost due to high escalation on prices major construction materials compensates the construction contractors by using price adjustment formula. Provision of contingencies in the contract document on account of price escalations may be provided so that a higher project cost may be allocated which will be less prone to variations on higher side.
- 5.2.2 Land acquisition and resettlement is now considered as one of the most significant factor for increasing a project cost. The highways projects with a scope of widening existing carriageway are now warranting a need of additional Right of Way (ROW) for which a land is to be acquired using Land Acquisition act of Pakistan. According to this act, the affected persons are liable to get a compensation based on current market rates.
- 5.2.3 Improper planning by major stakeholders i.e. Clients, Contractor and Consultant leads to a high project cost in comparison to actual cost. Projects are awarded to the contractors without complete possession of the site in start due to delayed land acquisition process. Inadequate site investigation in the initial phase also effects the project may include non-B.O.Q items which increases the project cost dramatically. There is a need for to ensure possession of complete project site before letter of acceptance is issued to contractors.

Higher cost should be allocated for investigation of ground conditions with skilled man power resources so that practical rates may be set in the start for execution.

5.3. Major Causes of Time Overruns

From the results of questionnaire surveys, ten major causes of delays that predominantly affect highway construction projects in Pakistan have been identified in Table 2. Delay in progress payments by Client, scored the highest relative importance index of 0.8258. This major factor was followed by contractor's incapability to do the job which scored RII of 0.7935 and ineffective planning and scheduling which scored RII of 0.7677. Delay in delivering site to the contractor scored 0.7484 while emerging factor of land acquisition & resettlement had RII value of 0.7355. The others factors were delay in decision making process by client, poor project (site) management by contractor, delay in obtaining permits, relocation of utilities and services and scope changes / additional work.

Table 2: Top Ten Time Overrun Factors

| S. No | Description | RII | Rank |
|-------|--|--------|------|
| i | Delay in progress payments by Client | 0.8258 | 1 |
| ii | Contractor's incapability to do the job | 0.7935 | 2 |
| iii | Delay in delivering site to the contractor | 0.7677 | 3 |
| iv | Ineffective planning and scheduling | 0.7484 | 4 |
| v | Land Acquisition & resettlement | 0.7355 | 5 |
| vi | Delay in decision making process by client | 0.7097 | 6 |
| vii | Poor project (site) management by contractor | 0.7032 | 7 |
| viii | Delay in obtaining permits | 0.6968 | 8 |
| ix | Relocation of utilities and services | 0.6839 | 9 |
| x | Scope changes/additional work | 0.6774 | 10 |

5.4. Discussion on Three Major Time Overrun Factors

- 5.4.1 Delay in processing of interim payment certificates is the most significant factor which contributes to delays on a project. On payment delays, construction contractors reduce the pace of works in accordance to the conditions of contract. The client is bound to award an extension of services due to non obligation of contract conditions. There is a severe need of funds assurance by the client and timely processing and verification of bills by client and consultants.
- 5.4.2 The ability of a contractor to complete the certain job within allotted time period is very vital to be considered at the time of award. The contractors, due to lack of technology advancement, skilled man power resources severely affect the project with respect to time. The contractor's financial proposal must be assessed meticulously and on site resources must be ensured in accordance with the submitted financial proposal.
- 5.4.3 It has also been witnessed that many contracts were awarded to the contractors prior complete possession of site. The contractors are usually asked to commence civil works with all the resources. However, non-possession of complete project site not only leads to

delays but also results in non utilization of complete resources mobilized. Complete land acquisition and permits from other concerned departments should be ensured before letter of commencement.

6. Conclusion

The study was carried out to identify major factors causing cost and time overruns in highway projects of Pakistan separately. The major factors which contribute to increase in the project cost include Price escalation on major construction material / Price Adjustment, Land Acquisition & Resettlement, Improper planning, Inappropriate government policies & priorities and Additional Work. Factors like Delay in progress payments by Client, Contractor's incapability to do the job, Delay in delivering site to the contractor, Ineffective planning and scheduling and Land Acquisition & resettlement were identified as the major reasons due to which duration of highway projects go beyond the original scheduled period. It was unanimously agreed by all the respondents that cost and time overruns are very much the 'twin evils' for road construction sector of Pakistan, as huge cost and time variation has been recorded on many projects. Most of the identified factors come under the responsibility of client. Therefore a considerable amount of attention is required to build and implement a policy so as to ensure reduction in impacts of identified factors for a prosper construction of highways in the country.

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