



# Material and equipment procurement delays in highway projects in Nepal

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## Abstract

Delay in the delivery of materials and equipment to construction sites is often thought of as a contributory cause of cost overruns in construction projects in developing countries. A cursory examination of the environment in which projects are executed in developing countries appears to support this thinking. However, there does not seem to have been much research work conducted that investigates whether this is actually the case and also assesses the causes of these delays and magnitude of their impacts on project costs. This research was aimed at firstly ascertaining the occurrence of material and equipment procurement delays in highway projects in Nepal. An assessment of the causes of the delays and the magnitude of their impact on project costs was also made. The survey method was used in conducting this research involving 22 highway projects. The main causes of material and equipment procurement delay were found to be (in rank order) organizational weaknesses, suppliers' defaults, governmental regulations and transportation delays. However, the actual impact of these delays on project costs was found to be on average, only about 0.5% of the total budgeted cost of the projects. Among materials, delays in the supply of aggregates were found to occur most frequently while delays associated with pavers occurred most frequently among equipment.

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## 1. Introduction

The primary goal of any construction project is the transformation of the expressed desire of the owner into tangible artefacts that satisfies that desire. For such transformations to be cost-effective, human and material resources have to be garnered and managed with the highest degrees of efficiency achievable. Since any artefact or structure is much more than the sum of the materials that comprise the structure, it stands to reason, that at the very least, a prerequisite for cost-effective construction is the availability of materials at the time and location that these materials are required on site. Not any less important are the equipment and manpower required to place these materials in the exact

location and sequence that have been prescribed either in the contract documents or dictated by acceptable standard practices in the industry. The term procurement encompasses a wide range of activities that includes purchasing of equipment, materials, labour and services required for construction and implementation of a project [1]. However, this paper uses the term in the limited context of materials and equipment.

## 2. Motivation for research

The importance of material procurement mainly stems from the fact that the cost of materials constitutes a significant part of project costs [2]. The general notion that is prevalent both in academia and industry is that shortage of materials and equipment required for construction is a grounded reality in construction projects in developing countries. Ofori [3] notes that such

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shortages are significant and adversely affect these projects. In fact, even a cursory examination of the environments in which construction projects are executed in developing countries will reinforce Ofori's observation. Although there have been a number of research efforts that have dwelt on the broad area of construction in developing countries [4–14], to the best of the authors' knowledge there has not been any prior work done in the area of materials and equipment procurement delays in construction projects. While a comprehensive research effort to ascertain the existence or otherwise of material and equipment shortages on a global scale would be prohibitively expensive and take an inordinate amount of time, Ofori's work does stimulate interest in a more feasible investigation within the narrow confines of particular sectors of the construction industry in a developing country. The motivation for the investigation stems not only from the fact that many developing countries are now undertaking massive infrastructure development projects [15] but perhaps more importantly the effects of poor performance in these projects can prove to be extremely detrimental to the often fragile economies of these countries

### 3. Research objectives

To help precisely define the scope and objectives of the research, the authors decided to substitute the phrase "procurement delays" for "shortages" as it was felt that the shortages could in the extreme case be interpreted to mean a shortfall leading to cessation of work on the project. The primary objectives of this research were to: (a) ascertain the occurrence of material and equipment procurement delays in highway projects in Nepal and (b) determine the causes of the delays. The secondary objective was to estimate the impact of the delays on project costs.

### 4. Research methodology

The survey method was used in this research as it was found to be well suited to the task of collecting the information required. Both qualitative and quantitative information was utilised in the research. Whilst qualitative information was required to establish the incidence of procurement delays and establish the causes of the delays, quantitative information was required to estimate the impact of the delays on project costs. In all, 22 highway projects were surveyed as part of this research.

Primary data was collected with a view to gaining an understanding of the policies and procedures used for materials and equipment procurement. It also helped us obtain general perceptions of the problems in the area of materials and equipment procurement prevalent

among the personnel working on the projects and more specifically gain insights into the nature of the manifestations of the causes of procurement delays. The instruments used for collecting primary data were semi-structured interviews. The questions used for the semi-structured interviews are listed in the Appendix.

The paucity of secondary data sources was a major obstacle that would have been difficult to overcome were it not for the fact that one of the authors had intimate knowledge of the workings of the Nepalese construction industry in general and highway projects in particular. As is the case in many developing countries of the world, most field-related operations in the construction industry are carried out without the help of any form of records of these transactions. This fact probably explains in part, the lack of documented research work in the area. The secondary data obtained was painstakingly collected taking advantage of personal contacts and were predominantly from records in the purchasing departments of firms, site offices and on-site stores. This was supplemented by directed questions addressed to these individuals and the answers elicited were used to fill the gaps in the information required for the research. To answer questions the interviewees often had to refer to their record of events and jottings in personal diaries. The secondary data obtained were the planned order date, actual order date, planned delivery date and actual delivery date for the following items that were most commonly used in highway projects in Nepal:

1. Aggregates
2. Cement
3. Bitumen
4. Gravel
5. Earthwork equipment
6. Asphalt mixer
7. Galvanized Iron (G.I.) wire
8. Steel Reinforcement
9. Compaction equipment

In addition, information on acceleration costs, liquidated damages, labour and equipment usage, sanctioned overtime and overtime rates were obtained. Hiring rates for equipment was obtained from the Department of Roads, Ministry of Works and Transport, His Majesty's Government as amended in January 1998. Costs of liquidated damages were obtained from contract documents of respective projects.

### 5. Data analysis

The symbols used in this section have the following meanings:

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