

AC 2008-108: THE EFFECT OF POLITICAL UNREST ON CONSTRUCTION TIME FOR FOOD GRAIN WAREHOUSES IN BANGLADESH

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The effect of political unrest on construction time for food grain warehouses in Bangladesh

Abstract

The purpose of this study was to examine the factors that effect actual construction time in the context of food sector projects in Bangladesh. One of the factors of particular interest is political unrest. The data for the study was obtained from a leading design and construction management company in Bangladesh. The sample size consisted of data for 104 food grain warehouse projects scattered all over the country. The effect of political unrest on construction time was analyzed in conjunction with other known variables of time overrun, such as increase in project cost and delay in procurement of construction materials. The results indicated that the effect local political unrest on construction time was statistically significant even in the presence project cost and procurement of materials variables. It was concluded that political unrest could be included in prediction models used for finding out actual construction time of food grain warehouse projects in Bangladesh. Based on these findings, a prediction model for construction time for such projects was developed.

Key words: Bangladesh Construction Industry, Construction Time, Construction Cost, Construction Materials, Food Grain Warehouses, International Construction, Political Unrest.

Statement of the Problem

Food grain warehouses

Bangladesh construction industry is growing steadily at a constant rate. Total construction expenditure of the country has increased from Tk. 100 billion in the early 1990's to more than Tk. 200 billion in 2004. Figure 1 shows a projection of the country's construction output as a percentage of GDP¹. Most of the construction works are in the public sector. Funding for a high percentage of construction projects come from multilateral development agencies (MDA) like the World Bank or Asian Development Bank. For large MDA funded projects, the usual practice to go for international competitive bidding. Most public contracts are awarded on the basis of the lowest responsive tenders submitted by contractors. Local contractors are given a margin of preference to secure public sector tenders under MDA funding. One of the areas on which most of the multilateral development agencies emphasize is food security, which is also a major concern for the government of Bangladesh

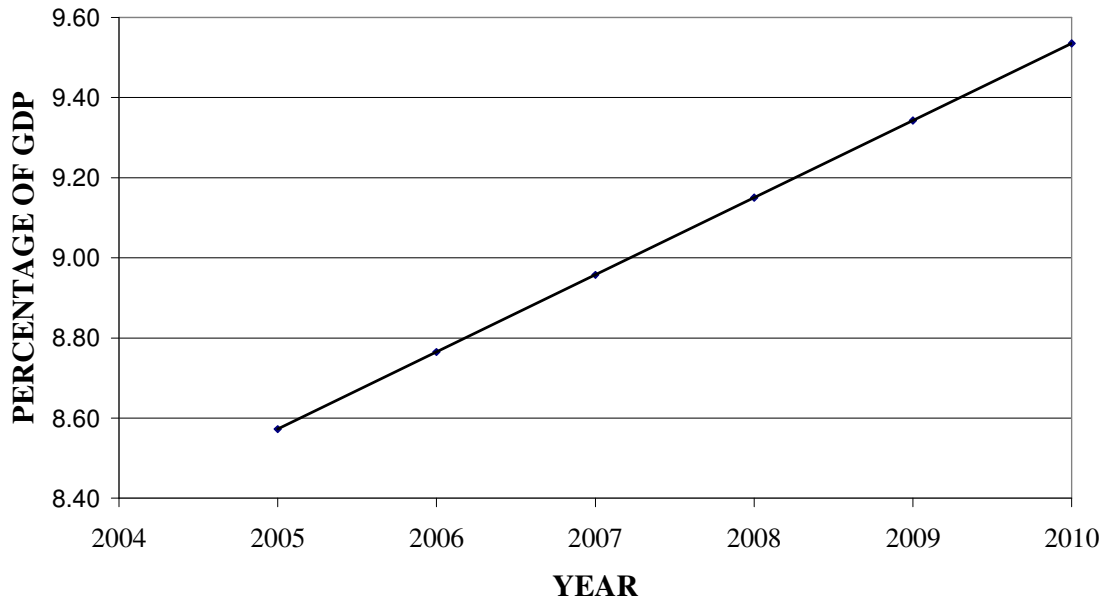


Figure 1. Projected share of construction sector in Bangladesh GDP

Food security has primarily two aspects: (1) family or household food security and (2) national food security. Household food security depends on the ability of the household wage earners to secure enough food to ensure an adequate dietary intake of all of its members at all times for a healthy and active life. National food security depends on the ability of the government to secure enough food for the whole nation. In Bangladesh food security at the national level directly affects the social and political situation of the country. Economically, national food security is closely related to total food production, internal food procurement, food aid, importing capacity, and a host of national and international issues. In order to provide national food security, it is essential to build warehouses for procurement, storage and distribution of food grains and to maintain smooth and well organized food management².

With the increase in food production as well as import of food grains to minimize the food gap, there is a continual need of increasing the food grain storage capacities. New construction of such ware houses and upgradation and retrofitting the existing ones are usually done with financial assistance from multilateral development agencies. Even though the responsibility of food management lies with the Ministry of Food of the Government of Bangladesh, the donor agencies employ private architectural/engineering companies to design, monitor, and supervise the construction and upgradation of warehouses funded by them. Contractors for such works are selected through competitive bidding².

Political risk and construction time of food grain warehouses

Political risk identification is one of the keys to success not only in international but also in domestic business, particularly in regions where political environment is less than

steady. Political situation in Bangladesh, like many other developing countries, is not very stable. Occurrence of protest marches or events leading to work closures are not uncommon. A major concern for any construction company before venturing on a project is whether the political situation in the country will change in such way that the operating position will deteriorate. It is very a much subjective business-specific event. Haendel³ defines it as the occurrence of events that may change the projections for profitability of a business venture of a given investment.

Political risk includes acts of war, civil disobedience, and labor relations that affect progress of works⁴. Wang et al.⁵ extends the list to include expropriation of assets, force majeure, delays in client approval, corruption, and changes in policies. One other factor that may be identified as political risk in Bangladesh is “hartal.” A term that signifies closing down of places business and education with the object of realizing a demand, it is a recognized political instrument to demonstrate people’s protest against the establishment. When a nationwide “hartal” is called by any political party, the country is forced to shut down. All educational institutions and commercial centers remain closed, modes of communications are disrupted. Movement of people, goods, and services are either restricted or completely stopped. Sometimes these events may only be site specific that the constructors usually refer as “local interference.” Even though the “hartals” may not directly affect construction works, they certainly have an indirect affect. The workers possibly cannot reach the work site in time due to restricted commuting facilities. It is also likely that disruption of transportation services would have an affect on the delivery of materials and equipment to the construction site. Food grain warehouses are located throughout the country, most of them in semi-urban and rural settings. Being far away from metropolitan areas, such events usually have little or no direct impact on construction works at these locations. But disruptions in transportation systems may have an effect on the availability of materials, labor, and equipment for construction. It will be of interest to find out the effect of political unrest or “hartal” on construction time of food grain warehouses in Bangladesh.

Other probable factors of construction time

Timely completion of construction or rehabilitation of food grain warehouses is critical because of food security issues. The Asian Development Bank⁶ reported that 39 percent of the projects funded by them were completed within the scheduled time. Factors identified for time overrun were change orders and delays in making administrative decisions.

Time and cost are two main concerns in construction projects^{7, 8, 9}. In the construction industry, contractors usually use previous experience to estimate the project duration and cost of a new project. Typically, a project is broken down into activities to which resources can be assigned and durations and casts estimated. The activities are linked according to work sequences to form network. CPM techniques are used to analyze the network to identify critical path(s) and project duration. In general, the more resources assigned to an activity, the less time it will take to complete the activity, but cost is usually higher. This trade off between time and cost gives construction planners both

challenges and opportunities to work out the best construction plan that optimizes time and cost to complete the project. It is quite possible that the construction time required to complete the project may be underestimated, leading to overrun. Thus actual completion cost of a project can also be considered as an important factor influencing time overrun in construction projects.

Change orders represent one of the largest sources of cost growth and, consequently, time overrun for construction projects¹⁰. Construction of food warehouse projects in Bangladesh is no exception. Because of the need of continuous improvement of the government's food security program, there may be changes even in an ongoing construction project.

In Bangladesh, construction materials such as cement and steel are imported. As such, availability of these materials may be a problem either due to inadequate quantity of material imported by the traders or hoarding of materials to create an artificial shortage. Availability of materials at some sites, particularly in rural areas, may be affected due to lack of transportation. A good number of construction projects in Bangladesh are not completed within the scheduled time period for the lack of timely procurement of construction materials.

Hypothesis

This paper attempts to find the effect of political unrest on the construction and rehabilitation of food grain warehouses in Bangladesh. From a review of literature and personal interviews with local professional involved with such projects, it is hypothesized that the actual construction time of food grain warehouses in Bangladesh is affected by political unrest or "hartal" even in the presence of other possible factors of construction time such as actual construction cost, availability of construction materials, and number of change orders.

Methodology

Data collection procedure and sample size

Data for 104 food grain warehouse construction projects were obtained from a leading design and construction management company in Bangladesh. The firm has provided design and construction management services for over 500 such projects funded by the European Economic Community, the Netherlands Government, and Asian Development Bank. The sample projects were undertaken and completed during last five years. The company was involved in design, preparation of construction documents, assisting the clients in the bidding process and selection of contractors, fulltime construction supervision, and project management of the works. All the projects were constructed by different contractors. The design and construction management company that provided the data did not provide any construction service for any of these projects.

Variables and their operationalization

Actual Construction time (*TIME*): It is the actual time measured for the completion of a food grain warehouse construction project. It was measured in months.

Actual Project cost (*COST*): It is the total cost of construction works of a health sector construction project. It was measured in millions taka, which is the unit of currency in Bangladesh (1 US dollar = 65 Bangladesh taka).

Change Order (*CHANGE*): It is the total number of items, not included in the contract, the contractor was asked to complete. It was measured in number of change order items.

Local interference (*LOCAL*): It was the reported interference to constructions works due to local political turmoil. It was a dummy variable. A value of 1 was assigned for a project that faced at least one political turmoil during the construction period, and 0 otherwise.

Procurement of Construction Materials (*MATERIAL*): It was the reported procurement of construction materials in time for construction. It was a dummy variable. A value of 1 was assigned for a project in which the contractor failed to procure major construction materials as per schedule at least once during the construction period, and 0 otherwise.

Results

Analysis

A general linear model was used to analyze the data. The following model was used for the analysis:

$$\text{TIME} = \beta_0 + \beta_1 \text{COST} + \beta_2 \text{CHANGE} + \beta_3 \text{LOCAL} + \beta_4 \text{MATERIAL} + e \quad (1)$$

where TIME = actual construction time of a food grain warehouse project in months, COST = actual construction cost of a food grain warehouse project in million Taka, CHANGE = number change orders made during the construction period, LOCAL = reported local political interference at site during construction of a project, MATERIAL = reported procurement of construction materials as per schedule, β_0, β_1 , etc. = regression coefficients, and e = error term.

The results of the analysis are shown in Table 1.

Table 1

General Linear Model Analysis for TIME

Variable	Intercept/ Regression coefficient	T	p> T
Intercept	16.177	16.802	<0.0001
COST	0.192	5.216	<0.0001
CHANGE	0.021	0.057	0.9550
LOCAL	-5.186	-3.763	<0.0001
MATERIAL	-8.696	-9.146	<0.0001
LOCAL*MATERIAL	7.716	5.206	<0.0001
F-value of the Model = 62.21	p>Model F= 0.0001	Model R ² = 0.76 Adj. R ² = 0.75	

Interpretations

The F-value of the model used for multiple regression analysis was found to be statistically significant at less than the 0.0001 level. This provides evidence that a relationship exists between actual construction time and the independent variables used in the model.

An important aspect of a statistical procedure that derives model from empirical data is to indicate how well the model predicts results. A widely used measure the predictive efficacy of a model is its coefficient of determination, or R² value. If there is a perfect relation between the dependent and independent variables, R² is 1. In case of no relationship between the dependent and independent variables, R² is 0. Predictive efficacy of this particular model was found to be moderately high with an R² of 0.76, and an adjusted R² of 0.75. All the independent variables, except change order, included in the model were correlated to actual construction time at a very high level of significance with a p-value of less than 0.0001. The effect of interaction of political unrest with procurement of construction materials was also found to be statistically significant with a similar p-value.

Using only the variables that have a statistically effect on construction time, the model could now be rewritten as follows:

$$\text{TIME} = 16.177 + 0.192*\text{COST} - 5.186*\text{LOCAL} - 8.696*\text{MATERIAL} + 7.716*\text{LOCAL}*\text{MATERIAL} \quad (2)$$

It means that if there is no occurrence of a “hartal” during the execution stage of a food grain warehouse project, the construction time is predicted to be shortened by more than five days. In case of procurement of materials as per schedule, actual construction time is predicted to be less by more than eight days. Actual construction time will increase by 0.192 day for every increase of one million taka in project cost. A food grain warehouse

project with cost of say, 50 million taka without facing any political unrest and materials shortage during execution period is predicted to be completed in 19.6 months.

Conclusions

The results of the statistical analysis indicate that variability in actual construction time of a food grain warehouse project in Bangladesh is affected by political unrest even though such events may not take place at or near the project location. They also indicate that variability in actual construction time of such a project may be explained by actual construction cost and procurement of major construction materials in time. The model is useful for all parties associated with the construction industry to predict the mean time required for the delivery of a project. It provides an alternative and logical method for estimating construction time, both by bidders and clients, to supplement the prevailing practice of estimation predominantly on individual experience. The model can also be used as a teaching tool for graduate classes in international construction, both at graduate and undergraduate levels. The study will hopefully generate enough interest to do further research for deriving models to predict construction time for projects in other sectors.

The study was limited to investigate only the effect of cost, change orders, availability of construction materials, and political unrest on construction time in the context of food sector projects in Bangladesh, keeping all other variables constant. For future studies, it will be useful to include other variables such as productivity of the workforce, impact of client decision-making, delays in making progress payments, etc. and analyze their effect on total construction time.

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