



ORIGINAL ARTICLE

Effects of project's physical characteristics on cost deviation in road construction

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Abstract This study is conducted to investigate the effect of projects' physical characteristics on cost deviation in road construction using data from road construction projects awarded in the West Bank – Palestine over the years 2007–2010. The study is based on a sample of 74 road construction projects. Based on these data, regression models are developed. A questionnaire survey is also conducted to determine the impact of projects' physical characteristics on cost deviation in road construction. The questionnaire survey included 14 owners, 30 contractors, and 25 consultants. The considered characteristics are: project size (i.e. small, medium, and large), estimated cost, road length, road width, terrain conditions, soil and rock suitability, and soil and rock drill ability. The results reveal that the average of cost deviation in road construction is 16.73%, ranging from –20.33% to 56.01%. The correlation between cost deviation in road construction projects and the above mentioned parameters is investigated.

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1. Introduction

The construction industry is the tool through which a society achieves its goals of urban and rural development (Enshassi et al., 2006). It has a great impact on the economy of all countries (Leibing, 2001). However, it is at or near the top in the annual rate of business failures and resulting liabilities compared to other industries (Chapman, 2001). This is because of the sophistications of the construction process itself and the

large number of parties involved in the construction process (i.e. clients, users, designers, regulators, contractors, suppliers, subcontractors, and consultants). The construction industry and its parties are associated with high degree of risk due to the nature of construction business activities, processes, environment and organization. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects (Kartam and Kartam, 2001). According to Daniel and Andrew (2003), poor cost performance of construction projects seems to be the norm rather than the exception particularly in most developing countries where the problem is more acute.

Cost, time, and quality have their proven importance as the prime factors for project success. A project may not be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon

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to see a construction project failing to achieve its goal within the specified cost, time, and quality (Nega, 2008). The history of the construction industry is full of projects that were completed with significant cost overruns (Amehl et al., 2010).

In Palestine, the construction sector contributes to 26% of the Palestinian GDP (MAP, 2002). This is a relatively high proportion covered by this sector comparing to what is mentioned by Chitkara (2004) in that construction industry accounts 6–9% of GDP in many countries, thus it is strongly affecting various economic, social, and educational sectors. However, many local construction projects report poor performance due to many causes such as (Mahamid, 2011):

- experience in contracts,
- insufficient time for estimate,
- incomplete drawings,
- materials price fluctuation,
- political situation.

Therefore, attention should be paid to this important industry in order to figure out its main challenges and to be able to improve it.

This study aims at investigating the effect of project's physical characteristics on cost deviation in road construction based on data collection for 74 projects awarded in the West Bank in Palestine over the years 2007–2010, and through questionnaire survey. The considered characteristics are: project size (i.e. small, medium, and large), estimated cost, road length, road width, terrain conditions, soil and rock suitability, and soil and rock drill ability.

2. Literature review

Many studies were conducted to investigate the size and causes of cost deviation in construction projects. Al-Zarooni and Abdou (2000) conducted a survey to investigate variations in UAE public projects' estimates. They found that the variations (positive or negative) between feasibility and contract cost, ranging between –28.5% and +36%. They stated that these variations could be explained knowing that feasibility estimates in the government agencies are usually budgeted using a Single Unit Estimating (cost per square foot) basis, regardless of the nature of projects and their associated risks or the construction complexity of each building type.

Odeck and Skjeseth (1995) assessed Norwegian toll roads to reveal whether planning procedure shortcomings experienced by Norwegian road agencies had resulted in poorer than projected financial performances for some of the toll roads. They found overestimation of traffic forecasts and underestimation of construction costs. In their small sample of 12 toll projects, they found cost overruns on average at about 5%, but the interval was large from –210% to 170%.

Kaming et al. (1997) studied factors influencing time and cost performance on high-rise projects in Indonesia and concluded that cost and time overruns were very frequent. Omoregie and Radford (2006) reported a minimum average percentage escalation cost of projects in Nigeria to be 14%.

Akintoye (1998) conducted a study to gain an understanding of the factors influencing contractors' cost estimating practice through a comparative study of 84 UK contractors

classified into four categories, namely, very small, small, medium and large firms. The initial analysis of the 24 factors considered in the study shows that the main factors relevant to cost estimating practice are complexity of the project, scale and scope of construction, market conditions, method of construction, site constraints, client's financial position, buildability, and location of the project.

Jahren and Ashe (1990) conducted a research on predictors of cost overrun rates. They investigated the influence of the following items on construction project cost-overrun rates: project size, construction type, number of bidders, and the percent difference between the government estimate and the award amount. They found that the shape of the frequency distribution for the cost-overrun rate changed with the size of the project. Cost overruns occurred more frequently for larger projects.

Studies have shown that the size of a construction project (contract amount) influences the rate of cost overrun: Randolph et al. (1987) conducted a study on municipal contracts in Lansing; they found that cost overrun rates decreased as the contract amount increased. While Rowland (1981) found that cost overrun rates increased with increase in the contract amount of construction projects from a study of Southern United States construction contracts.

Shash and Abdulhadi (1992) have identified the factors affecting the accuracy of cost estimating in construction projects in Saudi Arabia. They found that the project characteristics are main affecting factors in cost deviation in construction projects.

Odeck (2004) investigated the statistical relationship between actual and estimated costs of road construction using data from Norwegian road construction over the years 1992–1995. The findings reveal a discrepancy between estimated and actual costs, with a mean cost overrun of 7.9% ranging from –59% to +183%. In absolute terms, cost overruns amounted to a formidable 519 million Norwegian kroner. He concluded that one particular new finding that has not been shown before in previous studies is that cost overruns appear to be more predominant among smaller projects as compared to larger ones. He also concluded that the size of cost overruns can be influenced by completion time of the projects and the regions where projects are situated.

Al-khaldi (1990) conducted a study aims at identifying factors affecting construction cost in Saudi Arabia from contractors and consultants' view. He found that project size is one of the top five affecting factors from both contractors and consultants' view.

Koleola and Henry (2008) concluded that the complexity of construction is one of the top six important factors affecting the accuracy of a pre-tender cost estimate in Nigerian construction projects.

Flyvbjerg et al. (2004) conducted a study of the causes of cost escalation in transport infrastructure projects. The study is based on a sample of 258 projects worth US\$90 billion. The focus is on the dependence of cost escalation on (1) the length of the project-implementation phase and (2) the size of the project.

They found that for the length of the implementation phase the main findings are:

- Cost escalation is highly dependent on the length of the project implementation phase.

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