

Contractors' Perspectives towards Factors Affecting Cost Estimation in Palestine

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ABSTRACT

Construction projects have certain characteristics that determine the appropriate actions to estimate their costs accurately. A key factor for a successful project is the preparation of an accurate estimate, which can influence factors ranging from project feasibility to profitability. The success or failure of a project is dependent on the accuracy of several estimates throughout the course of the project. Construction estimating is the compilation and analysis of many items that influence and contribute to the cost of a project. The purpose of this paper is to identify the essential factors related to cost estimation and to show the degree of importance of these factors in cost estimation of construction projects in the Gaza strip from contractors' perspective. The results of analyzing fifty-one factors considered in a questionnaire survey concluded that the main factors are: location of the project, segmentation of the Gaza strip and limitation of movements between areas, political situation and closure of the Gaza strip, financial status of the owner and increase in unit costs of construction materials. It is recommended to review cost estimation practice in terms of education and training required for those responsible for the estimating process. Contracting companies of various classifications are advised to provide training programs for their estimators to gain experience in cost estimation.

Keywords: Cost Estimation, Contractors, Building, Behavior.

INTRODUCTION

There is no doubt that construction is a key activity in any economy; it influences, and is influenced by, the Gross Domestic Product (GDP) of that nation (Cox and Townsend, 1998). To demonstrate, the construction industry provides jobs for 8 million people and creates a 12 percent slice of America's GDP (Levy, 2000). In Britain, the construction industry directly employs about

7 million people and accounts for about 8% of GDP (Ashwarth, 1994). In Germany, the construction industry accounts for about 10% of GDP and in Japan it accounts for about 18% of GDP (Cox and Townsend, 1998).

Construction is a vital activity in the Palestinian economy. It contributes substantially to the Palestinian GDP and employment (PCBS, 1999). According to the World Bank (2000), the construction industry contribution was 17% of the value added to the local GDP. The construction sector has played a crucial role in extending job opportunities for a lot of skilled, semi-skilled and unskilled Palestinian construction workers.

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The absolute number of domestic construction increased from 12.8 thousand in 1970 to reach 40.3 thousand in 1996. The share of this labor domestic employment has risen from 7.9% to 12% for the same period (PECDAR, 1997).

The private services (including trade, rental services and transportation) contributed 38% of the value added to the Palestinian economy. This is followed by public and community services, which contributed 23% of the value added. The other industries (manufacturing, quarrying, and the supply of utilities) contributed 16% to the value added in the year. Agriculture and fishing contributed 14% to the value added (World Bank, 1998). The objective of this study is to identify the essential factors related to cost estimation and to show the degree of importance of these factors in cost estimation of construction projects in the Gaza strip from contractors' perspectives.

BRIEF BACKGROUND

The construction industry in most countries is one of the extreme competitiveness, with high risks and low margins of profit when compared with other key industries. Consequently, pricing is one of the most important aspects of marketing in construction (Mochtar and Arditi, 200). Shash and Abdul-Hadi (1992) have identified the factors affecting the accuracy of cost estimating. These were classified as financial issues, bidding situations, project characteristics and the estimating process itself. Ashwarth (1994) summarized nine factors that have some influence on the accuracy of estimating the costs of construction work. These factors are: availability of the design information, type and quality of cost data, type of the project, project size, number of bidders on competitive projects, stability of market conditions, personal factors, proficiency in estimating and sheer quantitative experience. Additional factors that affect the accuracy of cost estimation have been identified. These are classified as financial issues, bidding situations, project characteristics and the estimating process itself (Akintoye and Fitzgerald, 1999; Shash, 1993).

The cost estimator, in the course of preparing a cost-estimate, is expected to carry out tasks such as a thorough examination of tender documents, a site visit, the preparation of methods statement and tender program, a visit to the project consultants, and to make inquiries and receive quotations for materials, plant and subcontractors (Akintoye, 1998). The major problems facing cost estimators in preparing cost estimates, in order of importance are: tough competition, contract period, incomplete drawings and specification, incomplete project scope definition, unforeseeable changes in materials prices, changes in owners requirements, current workload, errors in judgment, inadequate production time data, lack of historical data for similar jobs and lack of experience in similar projects (Akintoye and Fitzgerald, 1999; Shash, 1993). Project complexity, project information, technological requirements, contract conditions, contractor's efficiency, market requirements, project duration and project's risks have been identified as the main groups of factors which affect the accuracy of cost estimation (Sey and Dickbas, 1986; Shash, 1993; Shash and Abdul-Hadi, 1992; Ashwarth, 1994; Ahuja et al., 1994; Baccarini, 1996; Akintoye, 1998; Akintoy and Fitzgerald, 1999).

METHODOLOGY

This study has been conducted by means of a survey questionnaire with the objective of determining the more important variables that affect the accuracy of cost estimation. The dependent variable of this study is the accuracy of cost estimation in building contracts. The independent variables are the 51 factors that affect cost estimation. 32 variables were identified from previous studies (Sey and Dickbas, 1986; Shash, 1993; Shash and Abdul-Hadi, 1992; Ashwarth, 1994; Ahuja et al., 1994; Baccarini, 1996; Akintoye, 1998; Akintoy and Fitzgerald, 1999). A content validity test was conducted by sending the draft questionnaire with a covering letter to six experts to evaluate the content validity of the questionnaire, to check readability and offensiveness of the language and to add more factors and information if

needed. As a result, 19 additional variables were added to reflect the nature of the construction industry in the Gaza strip. These factors were amalgamated with the original factors and the required modifications were introduced to the final questionnaire.

The research population includes all contracting firms of first, second and third categories for building works that have a valid registration by the Palestinian Contractors Union (PCU) in the Gaza strip. The main criteria for classification are related to company's previous experience, capital, value of executed projects, staffing and financial situation during the last ten years. For example, first-category contractors are expected to have completed projects of value not less than six million US dollars over the past 10 years. The lists of contractors are annually published and the qualification of contractors is reviewed every two years by the National Committee for Contractors' Classification. The samples were selected randomly from each level of the three categories. In accordance to PCU records, it was noticed that the total number of operating contracting companies is 92. The target population was then distributed between three levels of companies: 42 of the first class, 39 of the second class and 11 of the third class.

The formula shown below was used to determine the sample size of unlimited population (Ayyub and McCuen, 1997; Creative Research Systems, 2005).

$$SS = \frac{Z^2 \times P \times (1 - P)}{C^2}$$

where SS = sample size

Z = Z value (e.g. for 95% confidence level)

P = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

C = confidence interval (0.5)

$$SS = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.5^2} = 384$$

The correction for finite population is:

$$\text{New } SS = \frac{ss}{1 + \frac{ss - 1}{pop.}}$$

$$\text{Where pop.} = SS = \frac{384}{1 + \frac{384 - 1}{92}} = 74.4 \approx 75$$

The calculated sample size was found to be 75 contracting companies based on a 95% confidence level with 5 as a confidence interval. In order to have a good representation for the target population, the target sample was distributed between the three levels of contracting companies according to their respective totals at Gaza's Contractors Union, as follows: first class companies (A) [75x42/92=34]; second class companies [75x39/92=32] and third class companies [75x11/92=9]. Therefore, the questionnaire was sent to 75 contracting companies. Respondents were asked to rate the extent to which the various factors influenced the accuracy of cost estimating on a five-point Likert scale, where grade 5 is for effects with very large degrees, 4 for effects with large degrees, 3 for effects with moderate degrees, 2 for effects with little degrees and 1 for effects with very little degrees. The response rate was 88% (31 first class companies, 27 second class companies and 8 third class companies). Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) software package.

RESULTS AND DISCUSSION

In this study, the factors that affect the accuracy of cost estimation in building contracts and their relative importance have been explored from the perspective of contracting firms of first, second and third categories of building works. The results of analyzing 51 factors considered in this study conclude that the main factors affecting the accuracy of cost estimation are: location of the project, segmentation of Gaza strip and limitation of movements between areas, political situation and the Gaza strip closure, financial status of the owner, increase in unit cost of construction materials, tender currency, experience of consultant engineer, number of competitors, clarity of information before execution and clarity of project drawings (Table 1). While these factors appear to be relevant to many developing countries, three

of the main factors (segmentation of the Gaza strip, limitation of movements between areas and political

situation) are considered to be relevant to the Gaza strip. These ten factors are discussed below.

Table 1: Overall ranks of 51 factors affecting the accuracy of cost estimation of building contracts.

Factors	Overall Mean Rank	Rank Order	1 st Class Contractors	Rank Order	2 nd Class Contractors	Rank Order	3 rd Class Contractors	Rank Order	F	P(v)
Location of Projects (hot areas, near settlements).	4.73	1	4.84	1	4.7	1	4.38	4	0.40	0.68
Segmentation of Gaza strip (limitation of movement).	4.58	2	4.55	2	4.52	2	4.88	1	0.51	0.61
Political situation and Gaza strip closure.	4.53	3	4.48	3	4.52	3	4.75	2	0.51	0.61
Financial status of the owner.	4.39	4	4.39	4	4.33	4	4.63	3	0.64	0.54
Increase in units' cost of construction materials.	4.11	5	4.13	5	4.22	6	3.63	12	1.10	0.36
Tender's currency.	4.02	6	3.83	10	4.3	5	3.75	11	0.90	0.43
Experience of consultant Engineer.	4.00	7	4.13	6	3.89	10	3.88	8	0.98	0.40
Number and classification of competitors during tendering.	3.95	8	3.84	9	4.19	7	3.63	13	0.92	0.43
Clarity and accuracy of Information related to the project before execution.	3.89	9	3.87	8	3.89	11	4	5	1.22	0.33
Clarity and quality of drawings before tendering.	3.86	10	3.97	7	3.7	13	4	6	1.06	0.38
Financial status of the company/contractor.	3.86	11	3.71	13	4	8	4	7	1.14	0.35
Method of payments.	3.76	12	3.71	14	3.78	12	3.88	9	1.55	0.26
Quality and information flow during the execution.	3.74	13	3.77	11	3.67	15	3.88	10	1.39	0.29
Time duration to execute the project.	3.59	14	3.58	15	3.59	17	3.63	14	1.36	0.29
Availability of project's resources.	3.55	15	3.77	12	3.41	18	3.13	20	2.05	0.17
Availability of qualified technical team at the company.	3.45	16	3.23	18	3.93	9	2.75	29	1.49	0.26
Accuracy of bill of quantities.	3.30	17	3.03	21	3.7	14	3	21	2.55	0.12
Types of project owner.	3.29	18	3.26	17	3.22	22	3.63	15	2.64	0.11
Volume of company's workload during estimation of new contract.	3.29	19	3.32	16	3.26	20	3.25	18	1.68	0.23
Expected variation orders and their frequency.	3.26	20	2.97	24	3.63	16	2.13	47	2.80	0.10
Procurement route and contractual arrangement.	3.15	21	3.13	19	3.33	19	2.63	33	2.20	0.15
Amount of specialist works.	3.12	22	3.1	20	3.26	21	2.75	30	2.49	0.13
Delivery that needs lead time (e. g. elevators).	3.05	23	2.87	31	3.11	24	3.5	16	2.20	0.15

Method of construction and construction technique.	3.02	24	3.03	22	3.04	29	2.88	23	3.09	0.08
Inflation.	2.95	25	2.9	26	3.07	26	2.75	31	2.62	0.11
Buildability of the project.	2.94	26	2.9	27	3.15	23	2.38	42	4.84	0.03
Advanced payments.	2.94	27	2.9	28	2.89	34	3.25	19	2.76	0.10
Complexity of design and construction.	2.92	28	2.94	25	2.93	32	2.88	24	2.53	0.12
Time duration to implement the estimation.	2.88	29	2.9	29	2.81	36	3	22	2.34	0.14
Time schedule for the project with all resources for estimation use.	2.85	30	2.9	30	3	31	2.13	48	4.23	0.04
Site constraints (e. g. access, storage ...).	2.79	31	2.55	34	2.85	35	3.5	17	3.06	0.09
Method of paying value added tax (VAT).	2.77	32	2.58	33	3.11	25	2.38	43	3.87	0.05
Time of execution (winter, summer).	2.74	33	2.55	35	2.93	33	2.88	25	2.77	0.10
Scale and scope of construction.	2.68	34	3	23	2.3	44	2.75	32	4.51	0.04
Equipment and their conditions at the company.	2.68	35	2.38	37	3.07	27	2.5	38	2.78	0.10
Expected natural forces (floods, storms).	2.58	36	2.06	44	3.07	28	2.88	26	1.78	0.21
Value of executed works outside the construction site.	2.53	37	2.74	32	2.26	47	2.63	34	2.22	0.15
Number of required staff to implement the project.	2.53	38	2.29	39	2.78	37	2.63	35	1.93	0.19
Method of solving disputes between the owner and contractor.	2.47	39	2.35	38	2.67	39	2.25	44	7.04	0.009
Percentage of losses in construction materials.	2.44	40	2.23	41	2.74	38	2.25	45	8.70	0.005
Type of structure (concrete, steel).	2.38	41	2.52	36	2.15	50	2.63	36	2.07	0.17
Liquidated damages amount.	2.36	42	1.65	50	3.04	30	2.88	27	2.79	0.10
Expected project organization.	2.33	43	2.23	42	2.41	42	2.5	39	2.89	0.10
Type and number of required tests for the project.	2.33	44	2.06	45	2.56	40	2.63	37	2.84	0.10
Amount and percentage of retention from payments.	2.27	45	2.19	43	2.3	45	2.5	40	4.50	0.03
Location of the project (town, village, camp).	2.24	46	2.26	40	2.04	51	2.88	28	2.12	0.16
Bid bonds and maintenance period.	2.09	47	1.87	46	2.3	46	2.25	46	2.32	0.14
Partnering with other construction companies.	2.03	48	1.84	47	2.22	48	2.13	49	3.69	0.06
Banks interest rate.	2.02	49	1.65	51	2.48	41	1.88	51	3.70	0.06
Topography of construction site.	2.00	50	1.68	48	2.22	49	2.5	41	2.93	0.09
Type and value of insurance for the project.	2.00	51	1.68	49	2.33	43	2.13	50	2.16	0.16

The results in Tables (1) and (2) indicated that the location of projects was ranked in the first position by the responding contractors with a mean value of 4.73. The contractors in the Gaza strip prefer to work in more secure areas rather than in projects located near Israeli settlements that can be classified as very dangerous areas. Contractors who wanted to work in these dangerous areas raise the costs of their tenders. Segmentation of the Gaza strip (limitation of movement between areas and non-availability of raw materials) was ranked in the second position with a mean value of 4.58. Segmentation of the Gaza strip has a very negative effect on estimation practice of tender documents. The segmentation means dividing the Gaza strip into two or three parts, which limits and sometimes prevents totally the free movement of manpower, goods and services. The responding contractors have ranked the political situation and the Gaza strip closure in the third position with a mean value of 4.53. The results of the survey as indicated in Tables (1) and (2) showed that these three factors have the most important effect on cost estimation practice in the Gaza strip. These factors have direct consequences on production performance on site and affecting the profitability of a particular project. For these reasons, the contractors in the Gaza strip are always reluctant to participate in those projects that are located near Israeli settlements or during comprehensive closure of the Gaza strip.

The findings in Tables (1) and (2) outlined that the financial status of the owner was ranked in the fourth position with a mean value of 4.39. The reliability in client financial status plays an important role in cost estimating practice in the Gaza strip. Some respondents stated that, for example, the Ministry of Finance has great financial difficulties; therefore, contractors raise the cost of their tender in order to face a possible financial risk. The continuous increase in unit cost of construction materials was ranked in position 5 with mean value of 4.11. This result is justified, as

contractors prefer to work in more stable market conditions. They usually take into account the trends in Gaza market conditions, which can be classified as instable, and the implications of the costs of resources on the project. In addition, tender currency had a significant importance as it was ranked in the sixth position with a mean value of 4.02. The local contractor preferred to estimate a tender with hard-currency such as US dollars rather than the local currency in Israeli shekels. Usually, contractors increase their estimates for tenders that use local currency to mitigate the risk of inflation and the increase in unit cost of construction raw materials priced in local currency.

The findings in Table (1) and Table (2) listed the experience of consultant engineer in the seventh position with a mean value of 4.00. The argument behind that was that the consultant engineers supply most important information during project implementation, therefore a well qualified consultant engineer will encourage the contractor to provide a more competitive price. This result can be interpreted as contracting firms in the Gaza strip are usually dependent upon project's consultant due to weakness in their organization. The results demonstrated that the number and classification of competitors to contracting companies have a large influence on cost estimating practice. It was ranked by the responding contractors in the eighth position with a mean value of 3.95. Clarity and accuracy of information before execution, and clarity and quality of drawings before tendering were ranked in the ninth and tenth position with mean values of 3.89 and 3.86, respectively. This result is justified as the contractors need such information in tenders cost estimate. More accurate information during tendering provides a more accurate tender price. Table (2) depicts the highest ten factors affecting accuracy of cost estimation as perceived by the three contracting classifications. It can be noticed from this table that there are minor differences in their perceptions.

Table 2: The highest ten factors affecting accuracy of cost estimation as indicated by large, medium and small sized construction companies in the Gaza strip.

Rank Order	Contractor Grouping		
	1 st Class Companies	2 nd Class Companies	3 rd Class Companies
1.	Location of project (hot areas)	Location of project (hot areas)	Segmentation of Gaza strip
2.	Segmentation of Gaza strip	Segmentation of Gaza strip	Closure of Gaza strip
3.	Closure of Gaza strip	Closure of Gaza strip	Financial status of the owner
4.	Financial status of the owner	Financial status of the owner	Location of project (hot areas)
5.	Increase in unit costs of construction materials	Tender's currency	Clarity and accuracy of information related to the project before execution
6.	Experience of consultant engineer	Increase in unit costs of construction materials	Clarity and quality of drawings before tendering
7.	Clarity and quality of drawings before tendering	Number and classification of competitors in tendering	Financial status of the company / contractor
8.	Clarity and accuracy of information related to the project before execution	Financial status of the company / contractor	Experience of consultant engineer
9.	Number and classification of competitors in tendering	Availability of qualified technical team at the company	Method of payments
10.	Tender's currency	Experience of consultant engineer	Quality of information and information flow during execution.

CONCLUSION

Construction and building projects are becoming progressively larger and more complex in terms of physical size and cost. Construction is a unique industry which is inherently risky because most projects must be priced before they are constructed, whereas in other industries the selling price is based on known manufacturing costs. A serious industry problem in most developing countries and especially in Palestine is inaccurate estimating. Numerous failures of contracting firms in Palestine were noticed in the past ten years. This can be attributed to many reasons, one of which is inaccurate estimating. In this study, the factors that affect the accuracy of cost estimation in building contracts and their relative importance have been explored from the

perspective of contracting firms of first, second and third categories of building works.

The results of analyzing 51 factors considered in this study conclude that the main ten factors affecting the accuracy of cost estimation are: location of the project, segmentation of Gaza strip and limitation of movements between areas, political situation and Gaza strip closure, financial status of the owner, increase of unit cost of construction materials, tender currency, experience of consultant engineer, number of competitors, clarity of information before execution and clarity of project drawings. While these factors appear to be relevant to many developing countries, three main factors (segmentation of the Gaza strip, limitation of movements between areas and political situation) are considered to be relevant to the Gaza strip. It is essential

that contracting companies of various classifications provide an on-site training program for their estimators to gain experience on cost estimation. There is an urgent

need to review cost estimation practice in terms of education and training required for those responsible for estimating function.

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