COST OVERRUN CAUSES IN PUBLIC CONSTRUCTION PROJECTS IN SAUDI ARABIA

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Abstract- This study is conducted to identify causes of cost deviations in public construction projects in Saudi Arabia from contractors' perspective. 41 factors that might affect cost estimating accuracy were identified through literature review and discussion with some construction experts. The factors were tabulated in a questionnaire form and a field survey included 51 contractors from the Northern Province of Saudi Arabia was performed. The results show that the top five important causes are: wrong estimation method, long period between design and time of implementation, cost of labor, cost of machinary and absence of construction-cost data.

Keywords Cost deviation, Public construction, Cost estimating, Saudi Arabia, Contractors.

I. INTRODUCTION

Cost estimating is a main element of the construction industry and its accuracy is one of the main project success measures. It is the process of accumulating, calculating and analyzing all the cost details. In almost all contract types, the preparation of an accurate cost estimate is an essential part of any construction operation.

However, the construction process is influenced by highly changing circumstances and unexpected events, resulting from a broad array of sources, such as performance of construction parties, financial issues, managerial issues, resources unavailability and external conditions. As a result, the construction of projects faces challenges affecting the cost estimating accuracy.

Cost estimating accuracy, therefore, is an important issue to the construction industry. Investigation into this problem area is needed to better manage cost deviation situations and to mitigate their consequences such as: delay, disputation, cost overrun, and failure. Identifying factors that affecting the accuracy of cost estimating and assessing their severity and frequency can provide insights for planning and taking risks into consideration in early phases of a project. This study aims at identifying the causes of cost deviations in public construction projects in Saudi Arabia from the contractors' perspective.

This objective is achieved through a questionnaire survey of 51 contractors from the Northern Province of Saudi Arabia. The survey included 41 possible factors affecting cost estimating accuracy in public construction projects. The survey is designed to measure the severity and frequency of the identified factors. It is hoped that the findings of this study will provide a solid overview of the knowledge domain for practitioners and fill an important research and practice gap

II. LITERATURE REVIEW

Many studies were conducted to identify factors affecting cost deviations in construction projects. Odeck (2003) 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%.. He concluded that cost overrun 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.

Mahamid and Bruland (2012) conducted a study to investigate the statistical relationship between actual and estimated cost of road construction projects using data from Palestinian road construction projects awarded over the years 2004 to 2008. The study was based on a sample of 169 road construction projects. The findings reveal that 100% of projects suffer from cost diverge.

They found that the discrepancy between estimated and actual cost has average of 14.56%, ranging from -39.3% to 98%. Mahamid (2011) conducted a study to identify the cost overrun causes in road construction projects in the West Bank in Palestine. Contractors input indicated that the top five cost overrun causes are: incomplete drawings, experience in contracts, insufficient time for estimate, segmentation of the West Bank and limitation of movements between areas, and political situation. While the consultants indicated that the top five factors affecting cost are: materials price fluctuation, insufficient time for

estimate, experience in contracts, size of contract, and incomplete drawings. Azhar et al. (2008) conducted a study to identify the major factors affecting cost estimating accuracy in the construction sector of Pakistan. 42 factors were short-listed to be made part of the survey questionnaire and the survey was conducted with representatives from local general contracting firms. They found that the top ten cost overrun factors in construction industry in Pakistan are: fluctuation in prices of raw materials, unstable cost of manufactured materials, high cost of machineries, lowest bidding procurement procedures, poor project (site) management/ poor cost control, delays between design and procurement phases, incorrect/ inappropriate methods of cost estimation, additional work, improper planning, and unsupportive government policies. Koushki et al. (2005) conducted a study in Kuwait to study the factors affecting cost estimating in construction projects. A person-interview survey of 450 randomly selected private residential project owners and developers have been done. They found that the main factors affecting are: contractor-related problems, material-related problems and owners' financial constraints.

III. RESEARCH METHOD

Fourty one (41) causes of cost deviations were identified through literature review and discussion with some parties involved in the construction industry. The factors were tabulated in a questionnaire form. The questionnaire was developed in order to evaluate the severity and frequency of the identified factors from the contractors' perspective. Data gathered through a field survey were analyzed by calculating severity index and frequency index from contractors' view.

Questionnaire design

The questionnaire is divided into two main parts. Part I is related to general information for the company. The contractors were requested to answer questions pertaining to their experience in the public construction industry. Part II includes the list of the identified factors affecting cost estimating in public construction. For each factor two questions were asked: "what is the severity level of this factor on cost estimating accuracy in public construction projects?" and "what is the frequency level of this factor?" The respondent has to choose one of the categories very high, high, moderate, low and very low (on 5 to 1 point scale).

The target population is all contractors for public construction works who have valid registration by the Commerce Champer of the Northern Province in Saudi Arabia. A sample of 63 contractors was randomly selected to fill out the questionnaire.

Data analysis

Factors ranking

Frequency index (F.I) and severity index (S.I) are calculated for each factor according to the following formula

$$\text{Index } (\%) = \sum a\,(n/N)*100/5 \qquad \text{Eq. (1)}$$

Where; a is the constant expressing weighting given to each response (ranges from 1 for very low up to 5 for very high) n is the frequency of the responses N is total number of responses The impact index (IMP.I) for each factor is calculated as a function of frequency index and severity index, as follow:

$$\text{Impact Index (IMP.I) } (\%) = [(\text{F.I}) (\%) * (\text{S.I}) (\%)] /100 \qquad \text{Eq. (2)}$$

IV. RESULTS AND DISCUSSION

General characteristics of respondents

The questionnaire was sent out to a total of 63 contractors, asking their contribution in identifying the priority of the identified 41 factors in terms of severity and frequency using an ordinal scale. A total of 51 contractors filled the questionnaire. The response rate by the contractors is 81%. Most of respondents have experience of more than 10 years in construction projects.

Ranking of overall factors

Table 1 shows the overall ranking of the identified factors which were considered to affect the cost estimating accuracy in public construction projects. The results indicate that out of the top ten factors, wrong estimation method ranked the highest with IMP.I of 78.81%. This is followed in descending order by long period between design and time of implementation, cost of labor, cost of machinery, absence of construction-cost data, inflationary pressure, waste on site, poor relationship between managers and labors, additional work, and frequent changes in design.

Table 1: Ranking of overall factors affecting cost estimating accuracy in public construction

Factor	S.I	F.I	IMP.I	Rank
wrong estimation method	90.52	87.07	78.81	1
long period between design and time of implementation	92.24	84.48	77.93	2

cost of labor	86.21	79.31	68.37	3
cost of machinary	87.07	76.72	66.80	4
absence of construction-cost data	89.66	71.55	64.15	5
inflationary pressure	87.93	70.69	62.16	6
waste on site	84.48	72.41	61.18	7
poor relationship between managers and labors	84.48	70.69	59.72	8
additional work	83.62	70.69	59.11	9
frequent changes in design	81.90	71.55	58.60	10
lack of coordination between design and contractors	82.76	70.69	58.50	11
project financing	80.17	72.41	58.06	12
lack of contractor experience	75.00	75.86	56.90	13
economic instability	78.45	68.97	54.10	14
transportation cost	78.45	66.38	52.07	15
poor productivity	74.14	69.83	51.77	16
disputes on site	74.14	68.97	51.13	17
bid award for lowest price	73.28	68.10	49.90	18
contract management	70.69	68.97	48.75	19
number of projects going at the same time	69.83	68.10	47.55	20
high machinary maintenance cost	69.83	67.24	46.95	21
monopoly of foreign companies	68.10	65.52	44.62	22
labors nationalities	69.83	63.79	44.55	23
poor financial control on site	62.93	68.97	43.40	24
number of competitors	69.83	61.21	42.74	25
level of competitors	69.83	60.34	42.14	26
social and cultural impacts	68.97	60.34	41.62	27
high interest rates by bankers	64.66	63.79	41.25	28
contractual procedure	64.66	62.93	40.69	29
government policies	67.24	60.34	40.58	30
inadequate production of raw materials by the country	69.83	57.76	40.33	31
effects of weather	68.97	56.03	38.64	32
cost of insurance	63.79	58.62	37.40	33
fraudulent practices and kickbacks	65.52	54.31	35.58	34
duration of contract period	58.62	56.03	32.85	35
project location	59.48	53.45	31.79	36
lack of adequate manpower	52.59	58.62	30.83	37
cost of materials	62.07	47.41	29.43	38
improper planning	51.72	52.59	27.20	39
fluctuation of prices of materials	56.03	47.41	26.57	40
manipulation of suppliers	48.28	50.86	24.55	41

Top affecting factors

Table 2 illustrates the top ten important factors affecting cost estimating in public construction projects in Saudi Arabia. The results show that each factor among the top ten important factors has a very high severity index (S.I > 80%), while only the top two important factors have very high frequency index (F.I >80%).

Table 2: Top ten important factors

Factor	S.I	F.I	IMP.I	Rank
wrong estimation method	90.52	87.07	78.81	1
long period between design and time of implementation	92.24	84.48	77.93	2
cost of labor	86.21	79.31	68.37	3
cost of machinary	87.07	76.72	66.80	4
absence of construction-cost data	89.66	71.55	64.15	5
inflationary pressure	87.93	70.69	62.16	6
waste on site	84.48	72.41	61.18	7
poor relationship between managers and labors	84.48	70.69	59.72	8
additional work	83.62	70.69	59.11	9
frequent changes in design	81.90	71.55	58.60	10

Table 3 illustrates the top ten severe factors affecting cost estimating in public construction projects in Saudi Arabia. As shown in the table, all factors have very high severity index.

Table 3: Top ten severe factors

Factor	S.I	Rank
long period between design and time of implementation	92.24	1
wrong estimation method	90.52	2
absence of construction-cost data	89.66	3
inflationary pressure	87.93	4
cost of machinary	87.07	5
cost of labor	86.21	6
waste on site	84.48	7
poor relationship between managers and labors	84.48	8
additional work	83.62	9
lack of coordination between design and contractors	82.76	10

Table 4 illustrates the top ten severe factors affecting cost estimating in public construction projects in Saudi Arabia. The table shows that only the top two factors have very high frequency index, while the others have high frequency index.

Table 4: Top ten frequent factors

Factor	F.I	Rank
wrong estimation method	87.07	1
long period between design and time of implementation	84.48	2
cost of labor	79.31	3
cost of machinary	76.72	4
lack of contractor experience	75.86	5
waste on site	72.41	6
project financing	72.41	7
absence of construction-cost data	71.55	8
frequent changes in design	71.55	9
inflationary pressure	70.69	10

CONCLUSION

This study aims at identifying the factors affecting cost estimating accuracy in public construction projects in Saudi Arabia from the contractors' perspective. This objective is achieved through a questionnaire survey of 51 contractors. The survey included 41 possible factors affecting cost estimating accuracy in public construction projects. The survey is designed to measure the severity and frequency of the factors affecting cost estimating in public construction projects.

The results show that the top five important factors are:

- wrong estimation method
- long period between design and time of implementation
- cost of labor
- cost of machinary
- absence of construction-cost data

The top five severe factors as assessed by the contractors are:

- long period between design and time of implementation
- wrong estimation method
- absence of construction-cost data
- inflationary pressure
- cost of machinary

The contractors identified the following factors as top five frequent factors:

- wrong estimation method
- long period between design and time of implementation
- cost of labor
- cost of machinary
- lack of contractor experience

ACKNOWLEDGEMENT

The present research work has been undertaken within the Binladen Research Chair on Quality and Productivity Improvement in the Construction Industry funded by the Saudi Binladen Constructions Group.

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