

DEVIATION IN THE COST OF PROJECTS

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Abstract

A successful project means that the project has completed its technical performance, schedule and costs are remained within the budget.

This paper explain the causes of the deviations occurring in the cost of the construction project, and determines the reasons of these differences between contractual cost and final cost of the construction project, through the study of literature review related to this field, and benefiting from the experience of workers in the field of building (owners, contractors) through designing a questionnaire, and finding the most ten important reasons and explain the relation between the contractual cost and the final cost according to these reasons. The difference between those values will be showed through diagrams drawn using statistical program. In addition to studying the effects of overrun costs on the advancing of the project, and identify the most five important effects. According to the results we can propose the right direction for the final cost evaluation and propose some measures that would help to control and adjust the deviation in the costs.

Keywords

cost; overrun; construction projects; delay; estimating costs

Introduction

There are several ways to estimate the cost of the construction project: simple and detailed. The process of estimating cost is usually done during the design stage, which should take long time and the designer must give attention to all details. Through practice, it has been shown the big deviation in the cost, which affects on most of the construction projects for various reasons. The increased costs resulting often come from additional works on the project, and it caused a delay and disruption of the project up to stop the works in the project, which leads to disputes and claims.

The aim of the research

Construction projects are often delivered with overruns time, which leads to cost overruns as well. Also cost overruns are necessarily lead to a longer time and to late projects .

The purpose of this paper is to:

- Identify the causes of the overrun of the costs, and the impact of overruns cost on the projects indicators.

- Evaluate those reasons to find out why the most common in terms of recurrence and the extent of its impact.
- To put some proposals and recommendations to avoid such overruns.

Literature review

The process of estimating the primary cost is for many owners a real challenge, and the reason for this is due to the appreciation of this is influenced by many factors and variables that can not identify or control it, because they are future things which are difficult to predict, as well as to prepare them for this estimate requires of them a long time and great effort to reach an initial estimate of the cost, which must be sufficiently precise because the decision-making at this stage would have a dramatic impact on the subsequent stages Khrbotly et al. [1]. S, Ahmed et al. [2] have designed a mathematical model, which has been proposed to predict at the overrun cost added because of the formal change orders in the building projects, in accordance with: the cost of contractual projects. According to Ahmed et al. [3] delay and cost overruns are a phenomenon in construction projects and have a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration and a general feeling of trepidation towards each other. Many studies have been conducted to identify the causes of cost overrun in construction projects. Al-Najjar [4] concluded that the top affecting factors that cause cost overrun in building construction projects in Gaza Strip as perceived by contractors were: lack of materials in markets, shortage of construction materials at site, delay of material delivery to site, cash problem during construction, and poor site management. Koushki et al. [5] conducted a study in Kuwait. They concluded that the main affecting causes of cost overrun are: changing orders, owners' financial constraints, and owners' lack of experience. Kaming et al. [6] conducted a study to identify the main factors affecting cost overrun in Indonesian construction projects. They concluded that inflationary increases in material cost, inaccurate material estimating, and project complexity are the main causes of cost overrun. Iyer et al. [7] concluded that the most factors affecting the cost overrun of construction projects in India are: conflict among project participants, ignorance and lack of knowledge, presence of poor project specific attributes and non existence of cooperation.

Varied reasons of overruns costs from one country to another and from one managerial system to another, but it is all of the above shows that the responsibility is distributed among the parties of the project in causing overruns important in most types of building projects, so after identifying these causes and rates of recurrence , have to shift attention to the effects resulting from these overruns. It was clear in most studies correlation between overrun costs and delays in the project itself.

Problematic research

- It is rare to be delivered construction project in Syria and other countries in the world according to the contractual cost. Which led to many disputes and claims.
- The correlation between the increase in the cost and delay, and vice versa, and its reflections.
- on the good completion of the project.

Research Hypothesis

- High level of cost overruns in most of the projects.
- Distributed the responsibilities of the overrun costs between the (owner, contractor).
- Change order will come in a higher rank between the causes of overrun costs.

Methodology

Overrun costs are one of the biggest problems in construction projects in developing countries, as cause a negative effects on the projects. In order to evaluate and analyse the causes of cost overrun

in building projects, the questionnaire has done through selecting 21 building project randomly (from the Syrian reality), and from the benefit of experience of project managers, contractors, and owners. And through literature related to the field of causes of overrun costs in construction projects has been reviewed over the last decade. Summary of causes of overrun costs from literature review, and a questionnaire results are shown in Table I.

In the second part of questionnaire was the respondents(contractors, and owners) were asked to identify their response category on 28 construction cost factors from Table I to definition the most important ten reasons, The another part of questionnaire focused on the effects of construction overruns cost in construction projects, and identify the most important five reasons.

Results

Cost overrun is defined as excess of actual cost over budget. Cost overrun is also sometimes called "cost escalation," "cost increase," or "budget overrun" (Zhu et al 2004)[8]. Cost overrun is defined as the change in contract amount divided by the original contract award amount .This calculation can be converted to a percentage for ease of comparison.

- **Data analysis and discussion of results**

To determine the ranking of different factors from the view point of contractors and owners, and compute the Relative Importance Index (I) have used the formulae as shown in Equation (1), Odeh and Battaineh [9]:

$$RII = \frac{\sum_{i=1}^4 W_i \cdot X_i}{\sum_{i=1}^4 X_i} \quad (1)$$

W_i = the weight assigned to it response = 1, 2, 3, 4, respectively

X_i = Frequency of the it response;

i = Response category index = 1, 2, 3 and 4 for Very important, Important, Less important, and Not important respectively.

Accordingly, W₁=3 for Very important, W₂=2 for Important, W₃=1 for Less important, and W₄=0 for Not important have been used for this analysis. To study the strength of relationship between two sets of ranking, the Spearman rank correlation coefficient was determined. The Spearman rank correlation coefficient is calculated using Equation (2):

$$rs = 1 - \frac{6 \sum d}{(N^3 - N)} \quad (2)$$

rs = Spearman rank correlation coefficient;

d = Difference in ranking between the contractors and the consultants;

N = The number of variables.

TABLE I: Summary of causes of overrun costs in bulding projects

S.NO	Causes of the overruns projects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Poor site management		√					√				√			√	√					√	
2	Ineffective planning of project														√			√			√	
3	Financial difficulties by contractor								√			√							√			
4	Shortage of labours						√				√											√
5	Delay in delivery of materials	√							√							√						√
6	Change orders by owner	√			√		√	√			√	√		√	√		√	√	√		√	
7	Lack of materials on market								√				√				√					
8	Lack of communication				√										√					√		
9	Lack of designer's experience									√												
10	Inaccurate estimates			√		√		√				√				√	√					√
11	Replace materials																	√	√			
12	Incompetent subcontractor								√						√							
13	Mistakes during construction				√		√							√			√					
14	Improper construction method		√			√										√						
15	Delay in decision-making								√		√		√		√				√			
16	Low productivity of labours				√					√		√				√		√		√		
17	Poor management		√	√			√				√			√							√	
18	Equipment unavailability					√			√									√				
19	Logistics			√																		
20	Complexity of the project											√			√	√	√					
21	Poor contract management								√										√	√		
22	Delayed cash flows by owners			√			√	√						√		√						√
23	Import materials					√					√		√		√			√		√	√	√
24	Mistakes in design documents	√							√	√		√					√		√			
25	Accepting lowest offers		√	√				√	√							√		√	√			
26	Change functional program	√			√								√									
27	Rising prices		√	√		√	√	√		√	√				√			√	√		√	
28	Inadequate contractor experience							√	√				√			√				√		√

➤ **Causes of overrun costs**

Summary of Relative Importance Index and rank for the causes of overrun costs in building projects is shown in Table II.

TABLEII: Summary of relative importance index and rank for the causes of overrun costs in building projects

S.NO	Causes of the overruns projects	OWNERS		CONTRACTOR		OVERALL	
		INDEX	RANK	INDEX	RANK	INDEX	RANK
1	Poor site management	2,66	13	2,58	13	2,62	18
2	Ineffective planning of project	2,63	15	3,04	6	2,84	9
3	Financial difficulties by contractor	2,12	20	2,44	17	2,28	27
4	Shortage of labours	2,72	11	2,72	10	2,72	12
5	Delay in delivery of materials	2,64	14	2,65	14	2,6	19
6	Change orders by owner	3,24	5	3,5	1	3,37	1
7	Lack of materials on market	2,58	15	2,56	14	2,57	21
8	Lack of communication	2,06	21	2,72	10	2,39	24
9	Lack of designer's experience	2,22	18	2,54	15	2,38	25
10	Inaccurate estimates	3,34	2	2,76	8	3,04	5
11	Replace materials	2,16	19	3,26	3	2,71	13
12	Incompetent subcontractor	2,82	8	2,32	20	2,57	21
13	Mistakes during construction	2,48	17	2,62	12	2,55	22
14	Improper construction method	2,96	7	2,4	18	2,68	15
15	Delay in decision-making	2,72	11	2,76	8	2,74	11
16	Low productivity of labours	2,55	16	2,74	9	2,65	16
17	Poor management	2,76	10	3,12	5	2,94	6
18	Equipment unavailability	2,76	10	2,5	16	2,63	17
19	Logistics	1,94	23	2,08	21	2,02	28
20	Complexity of the project	3,32	3	2,38	19	2,86	8
21	Poor contract management	1,74	24	3,12	5	2,43	23
22	Delayed cash flows by owners	3,06	10	2,72	6	2,89	7
23	Import materials	3,3	4	3,26	3	3,28	4
24	Mistakes in design documents	2,68	12	2,7	11	2,69	14
25	Accepting lowest offers	3,38	1	3,24	4	3,31	3
26	Change functional program	2,68	12	2,90	7	2,79	10
27	Rising prices	3,32	3	3,3	2	3,34	2
28	Inadequate contractor experience	2,78	9	1,86	22	2,32	26

Table III: The names of the projects.

S.NO	1	2	3	4	5	6	7
Project's name	School sand	Youth Housing C	School Guenins 3	School Guenins 4	Tower No. 28	School Aliu	Building deaf a dumb
S.NO	8	9	10	11	12	13	14
Project's name	Housing savings 1	Housing savings 7	School Albhloulih	General Administration	Technical Services	Commercial Bank	Administrative building of tobacco
S.NO	15	16	17	18	19	20	21
Project's name	Governor's Mansion	Building Faculty of Economics	Akamalat Faculty of Economics	Children's Hospital	Node Yemen	Faculty of Education	Expansion geometries

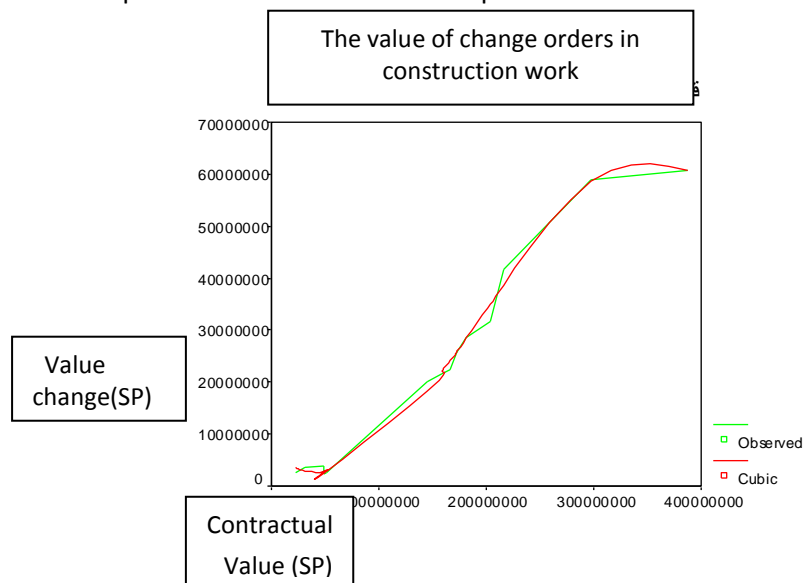
From the analysis of the results, it was found that change orders by owner during construction was in ranked first according to contractor viewpoint, but it was in rank five according to the owner's viewpoint. Also there was some causes in the same rank according to both (contractor ,owner), as an example: import materials, rising price. Another causes were different as an example: poor management, complexity of project. Moreover complexity of project is ranked much higher (Rank 3) by owner but this was ranked lower (Rank 19) by contractor.

To study the strength of relationship between two sets of ranking, the Spearman rank correlation coefficient was determined. The Spearman rank correlation coefficient is calculated using equation (2). The Spearman rank correlation coefficient is found to be 0.91 for these research data. This higher value of r_s (approaching 1) shows a strong agreement between owners and contractors for the ranking of the causes of delays. The collected data were statistically analysed further to determine the overall Relative Importance Index (RII) of these 28 causes of delays. Table III shows ten most important causes of overrun costs in building projects.

Table Iv: TEN MOST IMPORTANT CAUSES OF OVERRUN COST IN BUILDING PROJECTS.

S.NO	Causes of the overruns projects	OVERALL	
		INDEX	RANK
1	Change orders by owner	3,37	1
2	Rising prices	3.34	2
3	Accepting lowest offers	3.31	3
4	Import materials	3,28	4
5	Inaccurate estimates	3.04	5
6	Poor management	2,94	6
7	Delayed cash flows by owners	2,89	7
8	Complexity of the project	2,86	8
9	Ineffective planning of project	2,84	9
10	Change functional program	2,79	10

From the analysis of the result shown the change orders by owner during construction and rising price are high ranking (This is consistent with the hypothesis of the research, that: Change order will come in a higher rank between the causes of overrun costs). Moreover the analysis of the data shows that based on owner and contractor' points of view there some of reasons have the same rank, and this reasons are of overrun costs are from the overall top 10 causes of overrun costs. A lot of research focused on addressing the differences resulting from change orders, claims and lawsuits resulting from it, and to determine the predictability of obtaining those suits, while we note the scarcity of research concerned with the prediction of the impact of the change and the possibility avoided before reaching litigation, especially in Syria, which has noticed the growing problem of funding, lack of linked with the state budget, so Ahmed,S.et.al [2] have developed a mathematical model to predict the cost added as a result of the change.



(Figure 1) the relationship between the contractual value and change orders for construction work.[2]

The figure shows how the change's value increases as the increased of contractual 's value (by increasing from 20 to 30%), and thus increasing the value of the cost overrun. Where the value of the increase in costs resulting from change orders in this research was 31%.

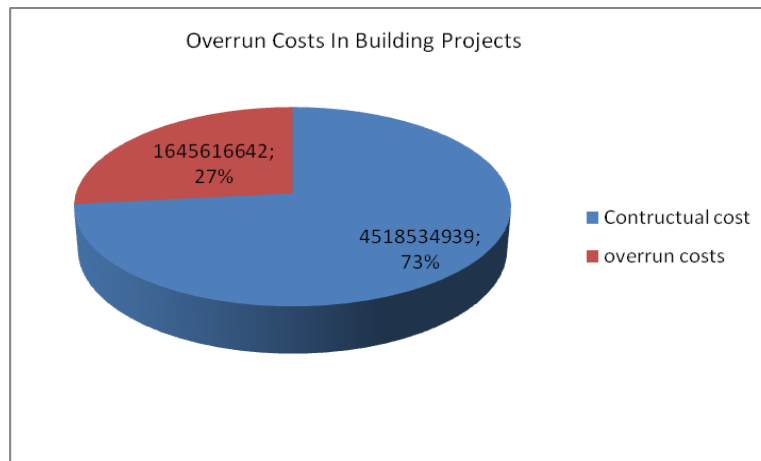
➤ Effects of overrun costs

According to the review as an example, the average increase was calculated in the cost of large-scale building projects, as was between 6_10% of the original value of the project [10]. Overrun costs can lead to many negative effects such as time overrun, cost overrun. The second part of questionnaire focused on the effects of overrun costs in building projects. Similar to the first part of the questionnaire, the respondents were asked to identify their response category on 5 construction effect factors from Table IV

TABLE V: RELATIVE IMPORTANCE INDEX AND RANK FOR THE EFFECTS

S.NO	Effects of the overruns costs	OWNERS		CONTRACTOR		OVERALL	
		INDEX	RANK	INDEX	RANK	INDEX	RANK
1	cost overrun	3,35	2	3.32	1	3	1
2	time overrun	3.2	1	3.12	2	3.16	2
3	claims and litigation	2,6	4	2.2	5	2.4	4
4	Total abandonment	2.9	3	2.8	3	2.85	3
5	dispute	2.2	5	2.4	4	2.3	5

From the analysis of the results, it is found that time overruns and cost overruns are ranked high by both owner and contractors. Moreover total abandonment is ranked the same (Rank 3) by both owner and contractors. The Spearman rank correlation coefficient is found to be 0.811 for these research data. This higher value of r_s (approaching 1) shows a agreement between contractors and owners for the ranking of the effects of overrun costs. *This too consistent with the hypothesis of the research, that there is a high level of cost overruns in most of the projects.*



(Figure 2) the Percentage of overrun costs in the building projects

Figure(2) shows through value of the overrun costs in the projects which have been reviewed in this research, (21 building project), their contractual cost is calculated and the total cost has found, then and using a statistical program found the deviation in the cost, it equal the difference between the total and contractual cost. the figure 2 shows its value is 27% of the total cost.

Conclusion

Most of the construction projects in all countries of the world are subject to overrun costs, and return this thing for many reasons. In this paper identify the most important causes of cost overruns from the viewpoint of the owner and the contractor, according to the studies referenced in this field, and in following the order of ten most important reasons of overrun costs: Change orders by owner, Change orders by owner, Rising prices, Accepting lowest offers, Import materials, Inaccurate estimates, Poor management, Delayed cash flows by owners, Complexity of the project, Ineffective planning of project, Change functional program. The paper also explained the relation between change order and the overrun costs. Also the paper identify the most important five effects of overrun costs, it was In the following order: cost overrun, time overrun, claims and litigation, Total abandonment, dispute. At last, has been Accounted the overrun in the cost of the studied projects, and it was 27% of the total cost.

Value of research

The outcome of this paper will assist owners, contractors, and consultants in understanding the reasons for cost overruns, thus eliminating or minimizing these causes. This could be achieved by better management of the projects and by finding new methods for storing the critical materials from the beginning of the project and clarify the scope of the change. Furthermore, the government

is advised to initiate legislation to overcome problems arising from monopolies in the supply of construction materials.

Subsequent studies:

_ Evaluate and develop the owner's management of the contract during the project life cycle.

_ Management of change orders.

References

- [1] Khrbotly,R., Omran,J., Hasan, B., "Uncertainty in cost estimating for Syrian Building Projects".2010. A Master Thesis Presented to the Tishreen university Syria.
- [2] Hasan,B., Jrad,F., Ahmed,s., "The study of the causes of change orders and analysis its impact on building projects in Syria" 2013. A Master Thesis Presented to the Tishreen university Syria.
- [3] Ahmed, S., Azhar, S., Kappagantula, P., and Gollapudi, D. (2003). "Delays in: A brief study of the Florida construction industry". Proceeding of the 39th Annual Conference of the Associated Schools of Construction. Clemson, South Carolina: Clemson University Miami, USA.
- [4] A. Enshassi, J. Al-Najjar, and M. Kumaraswamy, "Delays and cost overruns in the construction projects in the Gaza Strip," Journal of Financial Management of Property and Construction, vol. 14, pp. 126-151, 2009.
- [5] P. A. Koushki, K. AL-RashidA, and N. Kartam, "Delays and cost increases in the construction of private residential projects in Kuwait,"Construction Management and Economics, vol. 23, pp. 285–294, 2005.
- [6] Kaming, P., Olomolaiye, P., Holt, G., and Harris, F. (1997). "Factors influencing construction time and cost diverges on high-rise projects in Indonesia." Construction Management and Economics, 15, 83–94.
- [7] Iyer, K. and Jha, K. (2005). "Factors affecting cost performance: evidence from Indian construction projects." International Journal of Project Management, 23(4), 283-295.
- [9] A. M. Odeh, and H. T. Battaineh. "Causes of construction delay: traditional contracts". International Journal of Project Management, vol. 20, pp. 67-73, 2002.
- [10] Al-Dubaisi,H.,A.,(2000):"Change Orders in Construction Projects in Saudi Arabia"; A Master Thesis Presented to the King Fahd University of Petroleum & Minerals Dhahran, Saudi Arabia; pp 231-246.