

## COST PERFORMANCE FOR RESIDENTIAL BUILDING PROJECTS

Ibrahim Mahamid

*Assoc Prof, Civil Engineering Department, Faculty of Engineering, University of Prince Mughrin, Madinah,  
Assoc Prof, Civil Engineering Department, Faculty of Engineering, Arab American University, Palestine.  
Corresponding author: imahamid@ymail.com*

### ABSTRACT

The construction industry is one of the main sectors that play an essential role in the society's urban and rural development. It provides essential ingredients for the development of an economy. However, many construction projects experience extensive cost overrun. This study is conducted to; (1) reveal the magnitude and direction of cost overrun in building construction projects implemented in the West Bank - Palestine over the years 2013 to 2018, (2) develop prediction models for predicting project cost overrun based on the contract price value, (3) identify the causes of cost overrun in building construction contracts in the West Bank – Palestine, (4) test the importance of cost overrun causes from consultants and contractors' perspective. The authors used two methods of data collection to achieve the objectives of the study. These include: 1) field data collection for 102 building construction projects implemented in the West Bank during 2013 and 2018, and 2) a questionnaire survey conducted to identify and rank cost overrun causes from the perspectives of contractors and consultants. The findings reveal that 100% of projects suffers from cost overrun with an average of 34.58%, ranging from 15% to about 88%. The results show that cost overruns for building projects increased with contract prices. The questionnaire survey reveals that the top five cost overrun causes from combined view are: experience in contracts, insufficient time for the estimate, incomplete drawings, materials' price fluctuation, and political situation. The authors hope that the findings will guide efforts to improve the construction industry's performance in Palestine and other developing countries.

**Keywords:** cost overrun, diverge, buildings, building economy, construction, cost overrun causes.

### INTRODUCTION

The construction industry is a conglomeration of diverse fields and participants that have been loosely lumped together as a sector of the economy. The construction industry plays a central role in national welfare, including the development of residential housing, office buildings and industrial plants and the restoration of the nation's infrastructure and other public facilities. The importance of this industry lies in the function of its products which provide the foundation for industrial production (Hendrickson, 2008). The construction industry has the characteristics that distinguish it from other sectors of the economy. It is fragmented, sensitive to changing variables such as political and environmental factors, and has a significantly high business failure rate (Nega, 2008). The golden triangle (cost, time, and quality) measures the project performance and success. Generally, the success measure for a project is defined by accomplishing a project within specified cost, time and quality. However, the history of the construction industry worldwide is full of completed projects with significant time and cost overruns (Amhel et al., 2010).

Cost overrun is defined as the difference between the final actual cost of a construction project at completion and the contract amount agreed by and between the client and the contractor during the contract signing. Many factors affect the accuracy of the estimated cost in construction projects and should be considered at the early stages of the estimating process. Many of them may increase the project cost, leading to disputes between construction parties during and after project execution. Therefore, it is essential and helpful to identify these factors and to know their impact on project cost accuracy in order to control them.

In Palestine, the construction industry plays a basic role in providing homes, public facilities and infrastructure for economic enterprises, and improving the Palestinian national economy (Enshassi et al., 2006). It contributes to 14.6% of the Palestinian GDP (PCBS, 2012). This is a relatively high proportion covered by this sector comparing to what is mentioned by Chitkara (2004) in that the construction industry accounts for 6-9 % of GDP in many countries. Thus, it is strongly affecting various economic, social, educational, and vocational sectors. Therefore, attention should be paid to this vital sector in order to figure out its main challenges and to be able to improve it. The Palestinian construction industry also plays a significant role in the absorption of the Palestinian labour force instead of the manufacturing and agriculture industries. The construction industry share in the employment of the Palestinian labour force has increased continuously, and it is currently contributing around 11.6% of employment in Palestine (Salem, 2012). Despite the substantial success achieved by the construction industry in the Palestinian territories, in terms of economic growth, its contribution to the local output, employment and meeting partially, the local needs of the Palestinian society, this industry suffers from many problems that affect time, cost and quality performances and lead to prevent it from assuming its significant role in the Palestinian economy as is the situation in neighbouring and developing countries (Salem, 2012). Some of these problems summarized by Mahamid (2014) were: a large number of workers in comparison to the number of projects, shortage of materials due to Israeli limitations on the borders, lack in local construction materials, fluctuation in material prices, unstable economic situation, segmentation of the West Bank, and unstable political situation.

From the studies mentioned above, it appears that the problem of cost overrun is critical and should be studied more to alleviate this issue in the future. This study presents the findings of a field data collection and analysis and a questionnaire survey that aims at 1) identifying the magnitude and direction of cost overrun in building construction projects, 2) predicting project cost overrun based on the contract price value, 3) identifying cost overrun causes in building construction contracts. It is hoped that the findings will guide efforts to enhance the performance of the construction industry in Palestine. The objectives of this study are:

- To reveal the magnitude and direction of cost overrun in building construction projects implemented in the West Bank - Palestine from 2013 to 2018 based on the collected data.
- To develop prediction models for predicting project cost overrun based on the contract price value.
- To identify the causes of cost overrun in building construction contracts in the West Bank – Palestine.
- To test the importance of cost overrun causes from consultants and contractors' perspective.
- To formulate recommendations for improving construction performance.

## LITERATURE REVIEW

### Cost overrun magnitude

Cost overrun is typical in infrastructure, building, and technology projects. Researches on construction projects in some developing countries indicate that by the time a project is completed, the actual cost exceeds the original contract price by about 30 % (Mahamid, 2014). Mahamid and Bruland (2012) investigated the statistical relationship between the actual and

estimated cost of road construction projects implemented in the West Bank in Palestine. The study was based on a sample of 169 road construction projects. Based on this data, regression models revealed that 100% of projects suffer from cost overrun: 76% of projects were underestimated while 24% were overestimated. The overrun between estimated and actual costs was 14.6%, ranging from - 39% to 98%. The results showed that the relationship between the project size and the cost overrun is very weak. In Qatar, new construction projects are currently experiencing 54% cost overrun and 72% delay. On the other hand, the maintenance projects are experiencing 50% for both cost overrun and delay (Senouci et al., 2016).

### **Cost overrun causes**

Many studies had been conducted to investigate cost diverge in construction projects. Nega (2008) found that the most important causes of cost overrun in building construction projects in Ethiopia are inflation or increase in the cost of construction materials, poor planning and coordination, change orders due to enhancement required by clients, and excess quantity during construction. Azhar et al. (2008) conducted a study to identify the major cost overrun factors in the construction sector of Pakistan. Forty-two factors were short-listed to be made part of the survey questionnaire, and the survey was conducted with representatives from local general contracting firms. Results indicated that most cost overrun factors (88%) lie in the medium severity impact zone. They found that the top ten cost overrun factors in the construction industry in Pakistan are: fluctuation in prices of raw materials, unstable cost of manufactured materials, high cost of machinery, 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 unresponsive government policies. Kasimu (2012) concluded that the primary causes of cost overruns were: market conditions, personal experience in the contract work, insufficient estimated time for construction items, material fluctuation, and political situations. Shrestha et al. (2013) conducted a study of several public works projects in Nevada in the United States, and the results showed the negative and costly impacts of time delays. The study investigated several design-bid-build state construction projects between the years 1991 to 2008. It concluded that large size and long-duration projects had significantly higher cost and schedule overruns than smaller size and short-duration ones. Mahamid and Dmairi (2013) conducted a questionnaire survey to identify the major cost overrun causes in road construction projects in Palestine. The results indicated that the top five affecting causes were: fluctuation in the currency exchange rate, project financing, contract management, level of competitors, and cost of materials. Alghonamy (2015) found that among 34 factors affecting cost overrun in building projects in Saudi Arabia, the most critical factors include awarding the tender to the lowest bidder, design changes, poor planning, and delay in payments. Alzara et al. (2016) found a strong relationship between change orders and cost overrun in construction projects. Al-Hazim et al. (2017) investigated the factors that may cause overrun of the planned cost, allocated resources and scheduled time of infrastructure engineering projects in Jordan. The results showed that terrain and weather conditions are the top factors causing completion delay and cost overrun in infrastructure projects in Jordan. Al Amri and Marey (2020) concluded that the main factors affecting cost overrun are: change of project scope, poor management and poor drawings.

The above examples demonstrate that there are many factors with the potential to affect the project cost performance. As such, this paper builds upon the vast amount of published studies

(Azhar et al. 2008; Nega 2008; Kasimu 2012; Shrestha et al. 2013; Mahamid 2014; Al-Hazim et al. 2017; Al Amri and Marey 2020) to investigate the magnitude of cost overrun, develop cost overrun prediction models, and identify a comprehensive list of cost overrun causes in building construction projects. Following this, the paper shows the analysis of cost overrun magnitude using field data of 102 projects, develops cost overrun prediction models, and reports on the findings of a survey targeting project consultants and contractors in an attempt to shed some light on how each project party perceives the relative importance of these factors. Finally, the paper formulates several recommendations to bridge the gap between the different perceptions, thus improving the level of cost performance in Palestine. The literature review can assist with deep investigations and provide a solid overview of the knowledge domain for practitioners. This will fill a necessary research and practice gap.

## RESEARCH METHODOLOGY

The following steps were followed in order to achieve the study objectives:

- Field data was collected and analyzed to identify the magnitude and direction of cost overrun and to develop cost overrun prediction models
- A questionnaire survey was conducted to identify and rank cost overrun causes from the perspectives of contractors and consultants.

These steps are detailed in the subsequent sections.

### Field data collection and analysis

To investigate the cost overrun in construction projects, extensive historical data is required. The data were collected from engineering and contracting firms specializing in building construction projects in the West Bank. The data collected comprised 102 projects to investigated cost overrun in building construction projects. The projects awarded over the years 2013-2018. The data were tabulated to ensure that all costs were considered, none is double-counted, and all are clearly defined. All the data were deflated to the year 2018. To deflate the cost of a project in a particular year to cost in the year 2016, the cost is divided by the cost index value of that year.

Based on the collected data, the discrepancies between actual and estimated cost were studied and used to derive the magnitude and direction of the ratio  $\lambda$  of overrun once defined as:

$$\lambda_i = ((\kappa - \varepsilon) / \varepsilon)_i \quad i = 1 \dots n \quad \text{Equation (1)}$$

Where  $\kappa$  is the actual cost and  $\varepsilon$  is the estimated cost.

The projects were classified based on their cost, as shown in Table 1.

**Table 1** Classification of building construction projects in the West Bank (PCU, 2016)

Classification	Project size
< \$200000	small
\$200000 - \$400000	medium
> \$400000	large

Attention was paid to the following points during data collection:

- Distribution among a year of awarding

Consideration is taken to have an approximately equal number of implemented projects in each year over the year 2013 - 2018. Table 2 shows the distribution of projects based on year of completion.

**Table 2** Distribution of projects based on year of completion

Project year of completion	Number of projects
2013	16
2014	18
2015	16
2016	16
2017	18
2018	18

- Project size

Consideration is taken to have approximately equal distribution for collected data based on projects size, as shown in Table 3.

**Table 3** Projects distribution based on the size in the collected data

Project size	Numbers of projects
small	30
medium	36
large	36

### Model Development

Once the variables included in the proposed models have been identified, a series of mathematical models were developed using multiple regression analysis techniques. The linear regression model is selected to find the linear combination of independent variables, which best correlates with dependent variables. The regression equation is expressed as follows:

$$Y = C + b_1 X_1 + b_2 X_2 + \dots + b_n X_n \quad \text{Equation (2)}$$

Where,

C: regression constant.

$b_1, b_2, \dots, b_n$  : regression estimates.

$X_1, \dots, X_n$ : independent variables.

Y: dependent variable.

Excel statistical tools were employed to perform a linear regression analysis to identify possible relationships between the project contract price and cost overruns. The coefficient of determination  $R^2$  was used to measure the strength of these relationships. The closer the values of  $R^2$  are to 1, the stronger are the correlations between the variables. The cost overrun and contract price was set as the dependent and independent variables, respectively.

### **Questionnaire survey**

Fifty-one causes of cost overrun were identified through literature review and discussion with some parties involved in the construction industry. The causes were tabulated in a questionnaire form. The questionnaire was developed in order to evaluate the importance of the identified causes. Contractors and consultants' information (i.e. names, grade, and address) was collected from the Palestinian Union of Contractors (PCU). Data were gathered through a survey, analyzed using an importance index, taking in views from contractors and consultants. Agreement on the ranking of the importance of the causes of cost overrun between contractors and consultants was also tested. The following steps were followed to conduct the questionnaire:

### **Questionnaire design**

The questionnaire is divided into two main parts. Part I is related to general information for the company. Both contractors and consultants were further requested to answer questions about their experience in the construction industry. Part II includes the list of the identified causes of cost overrun in building construction projects. For each factor, a question was asked: what is the impact level of this cause on project cost overrun? Impact level was categorized on a five-point scale. It is categorized as follows: very high, high, moderate, low, and very low (on a 5 to 1 point scale).

### **Data analysis**

The information collected from the questionnaire is analyzed statistically by using Excel statistical tools. The statistical methods used for calculating and presenting the survey results are discussed below.

### **Ranking**

The suggested cost overrun causes in building construction projects are ranked by the measurement of the importance index.

*Importance index:* A formula is used to rank causes of cost overrun based on impact level as identified by the participants.

$$\text{Importance Index (\%)} = \sum a (n/N) *100/5 \quad \text{Equation (3)}$$

Where,  $a$  is the constant expressing weighting given to each response (ranges from 1 for very low influence up to 5 for very high).

$n$  is the frequency of the responses.

$N$  is the total number of responses.

The importance index for all causes was calculated according to equation (3) from contractors', consultants' and combined view. It should be clear that the cause's importance index from the combined view is calculated as a weighted average taking into account the total observations of

consultants and contractors. However, as the contractors are closer to the cost estimating process of a project, the combined view can be calculated by giving greater weight to contractors' responses. In this study, both the contractors and consultants get the same weight in calculating the importance index from a combined view. The following example shows the importance index calculation from contractors' view: suppose that 50 responses got from 50 contractors as follow: 1 (5 responses), 2 (4 responses), 3 (10 responses), 4 (20 responses), 5 (11 responses), then the importance index can be calculated using Equation 3 as following:

$$\text{Importance Index (\%)} = \sum a (n/N) * 100/5$$

$$\text{Importance Index (\%)} = [(1*5) + (2*4) + (3*10) + (4*20) + (5*11)]*100/50*5 = 71.2.$$

Same procedures used to calculate the importance index from consultants and combined view.

### **Spearman correlation**

Correlation is used to measure the degree of correspondence between two lists of ranks of the sample observation. This test is used to find and compare how well the contractors and consultants agree on the importance of the causes affecting cost overrun in building construction projects. A perfect positive correlation ( $r_s = +1$ ) means that the two samples rank each object identically. In contrast, a perfect negative correlation ( $r_s = -1$ ) means that the ranks of the two samples have an exactly inverse relationship. Values of  $r_s$  between -1 and +1 denote less than perfect correlation. The following formula is used for the calculation of the spearman rank correlation (Harnett and Murphy, 1975):

$$r_s = 1 - [6 * \sum d^2 / (n^3 - n)] \quad \text{Equation (4)}$$

Where;  $r_s$  = Spearman rank correlation coefficient (the agreement between contractors and consultants)

$d$  = difference between ranks on one variable and ranks on the other variable

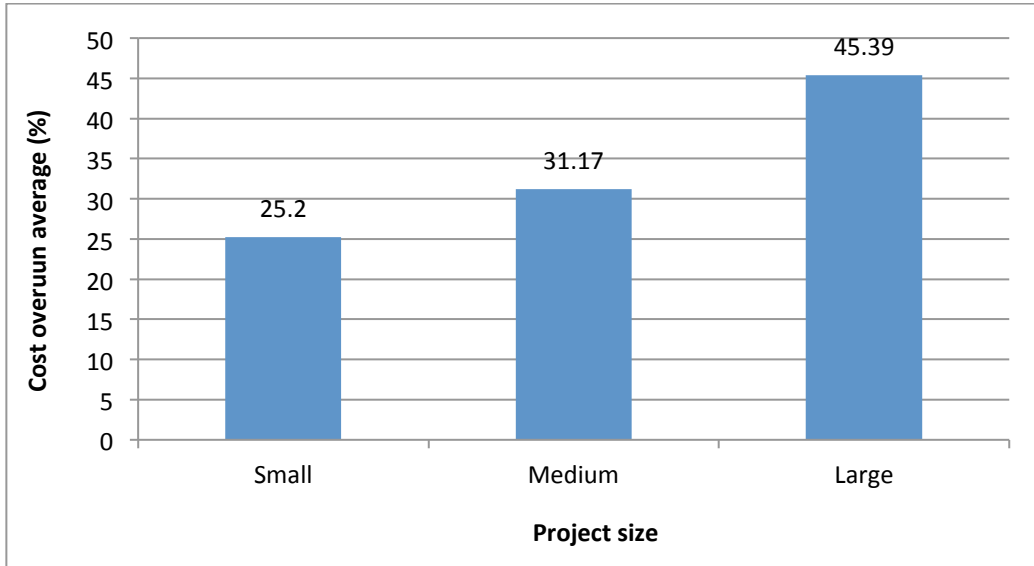
$n$  = number of causes

## **FINDINGS**

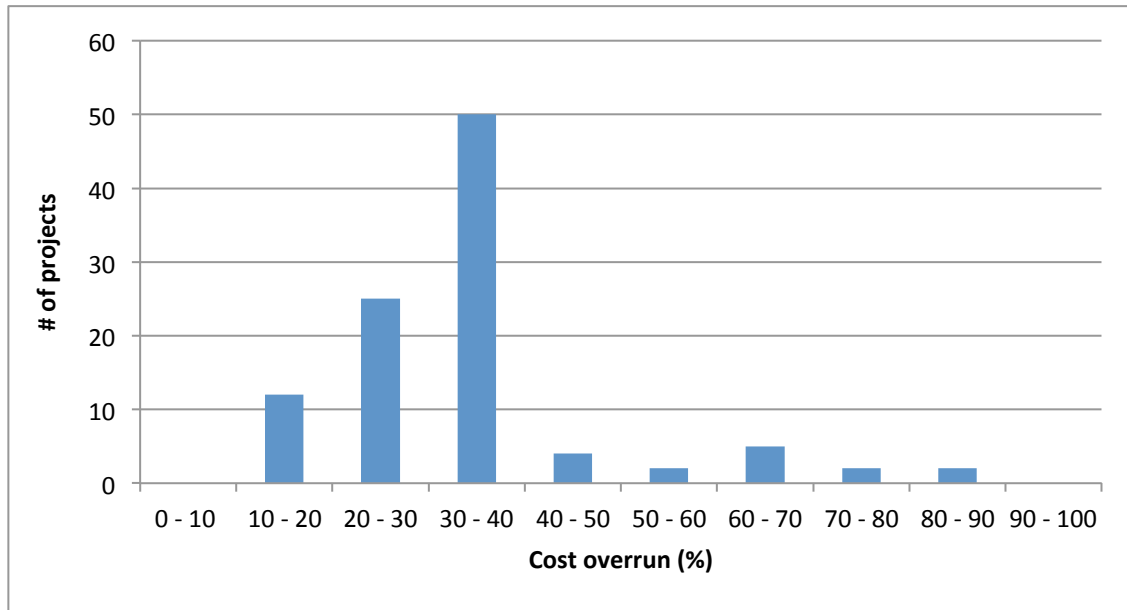
### **Analysis of cost overrun magnitude and direction**

For the collected data of 102 building construction projects, statistical analysis for cost overrun was performed. The results show the followings:

- 100% of projects suffer from cost overrun
- The average cost overrun is 34.58% ranging from 15% to about 88%
- The cost overrun is predominant in large projects: the average cost overrun for large projects is 45.39%, 31.17% for medium projects, and 25.20 for small projects (as shown in Figure 1)
- 75 out of 102 investigated projects have a cost overrun ratio between 20% and 40% (as shown in Figure 2)
- In absolute terms the total actual cost of 102 projects is \$58,664,959 while the total price contract is \$ 45,783,494; and the total cost overrun is \$ 12,881,465



**Fig. 1** Average of cost overrun in the collected data based on project size



**Fig. 2** Classification of cost overrun in the investigated 102 projects

### Linear regression

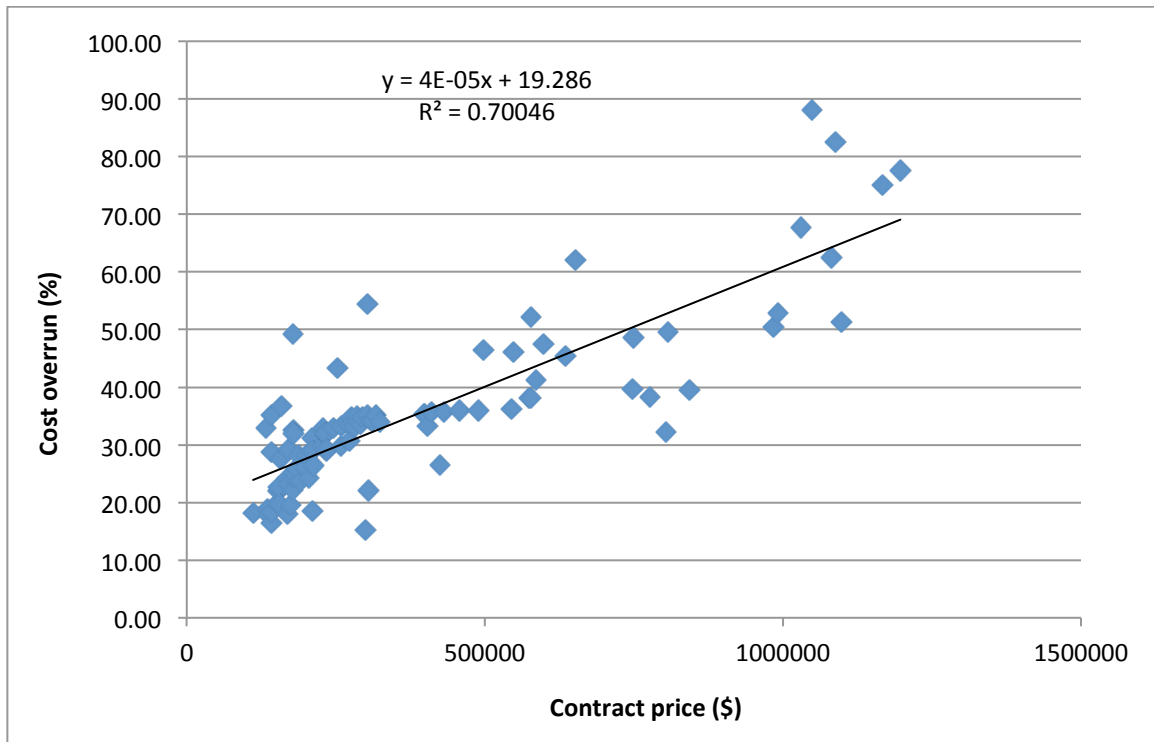
The regression analysis was used to develop cost overrun prediction models for building construction projects. The analyzed sample included 102 projects with contract prices ranging from \$110,000 to about \$1,200,000. Figure 3 shows a relatively good positive correlation between cost overruns and contract prices for building projects with  $R^2$  value of 0.70. This explains that the higher contract prices are, the higher the risks associated with the project due to its increased size and/or complexity.



Figure 3 shows the equation that describes the relation between cost overrun and contract price in building construction projects implemented in the West Bank in Palestine, and it is as follow:

$$y = 4E-05x + 19.28 \quad \text{Equation (5)}$$

where  $y$  = cost overrun (%),  $x$  = contract price (\$)



**Fig. 3** Project cost overrun versus contract price

### Cost overrun causes

#### General characteristics of respondents

The target populations in this study are the total number of building construction contractors, who have valid registration by the Palestinian Contractors Union, and the total number of consulting firms related to design and supervision works in building construction projects in the West Bank. It is worthy to note that the owners are not targeted because most of the owners of residential buildings in Palestine are ordinary people (not specialized), which might impact the reliability of the study. The contractors surveyed are categorized as grade 1 and 2 (i.e. the contractors are divided into five categories according to classification for contracting firms done by Palestinian Contractors Union based on company work experience, staff, number of employees, and instrument and machines owned by the company). Both participating consultants and contractors have an average of more than ten years of experience. Simple random sampling was used to select the participants from the available list.

The questionnaire was sent out to 60 contractors and 50 consultants, asking their contribution in ranking the identified 51 causes in terms of importance using an ordinal scale. A total of 52 contractors and 40 consultants filled the questionnaire. The response rate by contractors and consultants is 87% and 80%, respectively.

### Ranking of cost overrun causes

The importance index and ranking of all investigated 51 cost overrun causes in building construction projects in the West Bank from contractors' view, consultants' view, and combined view are listed in Table 4. The measurement of importance index ranks the causes according to Equation (3).

**Table 4** Overall ranking of cost overrun causes

Cause	Combined view		Contractors' view		Consultants' view	
	Importance index	Rank	Importance index	Rank	Importance index	Rank
experience in contracts	76.20	1	78.13	2	74.50	3
insufficient time for estimate	75.83	2	75.00	3	76.50	2
incomplete drawings	74.72	3	79.38	1	71.00	5
materials price fluctuation	74.17	4	70.00	9	77.50	1
political situation	72.22	5	73.75	5	71.00	6
segmentation of the West Bank and limitation of movements between areas	70.83	6	74.38	4	68.00	14
experience in the line of work	69.72	7	73.13	6	67.00	15
construction material waste on site	69.72	8	68.75	10	70.50	8
size of contract	68.33	9	66.88	13	71.50	4
duration of contract	68.06	10	65.63	16	69.00	11
lack of historical cost data	67.50	11	63.75	20	70.50	7
poor financial control	67.50	12	72.50	7	63.50	19
lack of information and coordination between parties	67.22	13	65.00	17	69.00	10
lack of qualified project manager	66.67	14	71.88	8	62.50	22
market conditions	66.67	15	63.13	21	69.50	9
poor quality of project management	66.11	16	66.25	15	66.00	16
inadequate labor productivity	64.17	17	64.38	18	63.00	20
lack of raw material sources	63.89	20	67.50	12	61.00	28
number of competitors	63.89	21	61.88	24	65.50	18
fluctuation in money exchange rate	63.61	22	66.25	14	61.50	23
relationship between labor and management team	63.33	23	63.75	19	63.00	21
type and content of contract	63.06	24	56.88	29	68.00	13
lack of application of risk management process	61.94	25	62.50	23	61.50	25
Inflation	61.39	26	61.25	25	61.50	24
inadequate specifications	60.83	27	60.00	26	61.50	26
knowledge of clients and consultants	60.28	28	53.13	38	66.00	17
lack of coordination between designers	59.72	29	58.75	27	60.50	30
Location	58.33	30	54.38	36	61.50	27
lack of skilled labor	57.50	31	56.25	30	58.50	34

payments delay	57.50	32	62.50	22	53.50	42
availability of finance management and plans	57.22	33	55.63	32	58.50	33
labor and equipment required	56.67	34	51.88	41	60.50	31
supplier manipulation	56.67	35	50.63	43	60.50	32
dealing with suppliers and traders	56.39	36	55.63	33	57.00	37
monopoly of material suppliers	54.44	37	55.00	34	54.00	41
financial status of owner	54.17	38	52.50	39	55.50	39
laws and regulations	53.33	39	48.13	44	57.50	36
soil quality	53.06	40	52.50	40	53.50	43
terrain conditions	53.06	41	46.88	46	58.00	35
unclear arbitration process	52.50	42	47.50	45	56.50	38
weather	52.22	43	56.25	31	49.00	48
Government requirements	50.83	44	46.25	47	54.50	40
estimating method used	50.28	45	54.38	35	47.00	49
ground conditions	50.28	46	51.88	42	50.00	46
public exposure of the project	47.22	47	40.00	51	53.00	45
high interest rate charged by bankers on loans	46.11	48	42.50	50	49.00	47
social and cultural impacts	45.56	49	44.38	48	46.50	50
taxes increase	45.00	50	53.75	37	53.00	44
insurance cost	41.11	51	43.13	49	39.50	51

### Rank correlation

The Spearman correlation is used to determine the association among the parties included in this study. This test is used to find and compare how well the contractors and consultants agree on the importance of the causes affecting cost overrun in building construction projects. By applying equation 4, the values of  $r_s$  are found to be equal to 0.79, which is close to +1, indicating a good agreement between consultants and contractors on the ranking of cost overrun causes.

### Top five causes

Table 5 shows that the top five costs overrun causes in building construction projects are (from the combined view): 1) experience in contracts, 2) insufficient time for the estimate, 3) incomplete drawings, 4) materials price fluctuation and 5) political situation.

Table 5 indicates that three out of the top five causes are in common between consultants and contractors, they are: incomplete drawings (ranked 3 and 5 from contractors and consultants, respectively), experience in contracts (ranked 1 and 3 from contractors and consultants, respectively), and insufficient time for the estimate (ranked 2 and 2 from contractors and consultants, respectively). “Political situation” (has overall rank 5 from combined view) has quite similar overall rank from contractors and consultants’ view; it ranks 5 from contractors’ view and ranks 6 from consultants’ view. However, they significantly differ in the overall ranking of “materials price fluctuation” (ranked 4 from combined view) that ranks 9 from contractors’ view and rank 1 from consultants’ view. This may be because contractors are in more contact with the market conditions. They can take actions to avoid the effect of materials price fluctuation (e.g. they might buy the materials and store them in case they expect fluctuation in material prices).

In summary, there is good agreement between contractors and consultants on the top five cost overrun causes. It can also be seen that many of the top causes that are concluded in this study are in line with many of the investigated literature. Illustrations of the top five causes presented in the following paragraphs.

### **Experience in contracts**

It is a fact from the learning effect that if a person does the same task or project more than one time, he or she will control it better with less time and less cost. One of the main problems that the Palestinian construction sector suffers from is the absence of skilled engineers, managers, and estimators, who are leaving to work abroad, mainly in the Arab Gulf, because of the better chances they get there and also because of the difficult political situation in Palestine. Regarding the labourers, most of them prefer to work in Israel because of the higher salaries they get comparing with what they get in the West Bank. This situation leads most construction companies to depend on low experienced staff. This result is in line with Kasimu (2012).

### **Insufficient time for the estimate**

Usually, the tendering period in building construction contracts lasts for 2 weeks from bid announcement to bids opening. According to the surveyed contractors and consultants, this is a relatively short time to prepare an accurate cost analysis taking into consideration the challenges and risks that affect cost estimating accuracy, especially when we are talking about low experience staff, as discussed before. This result is in line with Azhar et al. (2008) and Kasimu (2012).

### **Incomplete drawings**

A complete drawing is an essential part of preparing a bid price; incomplete drawing will lead to design changes and variations during the construction phase of the project, which may affect clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, and arbitration. The variations will interrupt the contractor schedule and lead to delay in the project, and as a result, the cost will increase. This result aligns with Azhar et al. (2008) that incomplete drawings are a critical cost overrun cause.

### **Materials price fluctuation**

Many investigated literatures show that material price fluctuation is the top cost overrun cause in construction projects. It is affected by many causes, e.g., inflation, supply and demand, monopoly and political situation. The construction sector in Palestine depends on importing construction materials from abroad. However, the Israeli constraints on Palestinian borders causing the delivery delay. This issue is leading to a material shortage in the local market and causing prices fluctuation. Fluctuation in construction material prices can be classified as an external factor that cannot be controlled internally by construction companies; therefore, the Government should make decision that benefit contractors to minimize the effects. This result is in line with Nega (2008) and Azhar et al. (2008).

### **Political situation**

The political situation in the West Bank is described as unstable because of occupation and the peace process. High costs of materials, lack of resources, limitations on material import, delay and monopoly are some results of the political situation in the West Bank. These results usually

lead to higher cost. This result is in line with Kasimu (2012) in that the political situation is one of the most severe causes affecting cost overrun.

**Table 5** Top five cost overrun causes from a combined view

Cause	Combined view		Contractors' view		Consultants' view	
	Importance index	Rank	Importance index	Rank	Importance index	Rank
Experience in contracts	76.20	1	78.13	2	74.50	3
Insufficient time for the estimate	75.83	2	75.00	3	76.50	2
Incomplete drawings	74.72	3	79.38	1	71.00	5
Materials price fluctuation	74.17	4	70.00	9	77.50	1
Political situation	72.22	5	73.75	5	71.00	6

## CONCLUSION

The study investigated cost performance in building construction projects implemented in the West Bank in Palestine over the year 2013 - 2018. PEC DAR provided a set of data from 102 building construction projects. The findings revealed that 100% of projects suffer from cost overrun with an average of 34.58%, ranging from 15% to about 88%. These results agreed with previous studies in that cost overrun is predominant in building construction projects. The result also showed that cost overrun is predominant in large projects.

A regression analysis was conducted to establish the relationships between project contract prices and cost overruns and develop prediction models for estimating cost overruns. A linear regression model was developed for predicting cost overruns for building projects. The results showed that cost overruns for building projects increased with contract prices. A significant effort was spent in collecting data on cost overruns in building construction projects. However, data confidentiality did allow the collection of enough data to ensure the robustness of the developed regression prediction models.

The study conducted a questionnaire survey to investigate cost overrun causes in building construction. It identified the causes of cost overrun and ranked them from contractors and consultants' perspectives. The importance index for each cause is calculated. Fifty-one causes of cost overrun were identified through research. The questionnaire survey included responses from 50 contractors and 42 consultants. The findings reveal that the top five affecting causes from combined view are: experience in contracts, insufficient time for the estimate, incomplete drawings, materials' price fluctuation, and political situation. The value of the Spearman rank correlation coefficient of 79% shows relatively a strong positive correlation between contractors and consultants in the ranking of the identified cost overrun causes.

All parties can recommend the following points in order to minimize and control cost overrun in building construction projects:

Government should give special attention to the followings:

- i. Conduct continuous training programs in co-operation with Palestinian Contractors Union to improve managerial skills of construction parties as well as labour skills; and
- ii. Conduct continuous updating on material prices and labour rates in cooperation with Contractors Union. The cost list should be distributed to construction professionals to develop the best estimates when there is a change in the cost of certain items; and

- iii. Modify and improve the regulations and laws to meet the impact of closure and segmentation of the West Bank. Such new regulations are supposed to make it more possible for companies to make profits.

Owners should give special attention to the following:

- i. Allow sufficient time to prepare project briefs and other feasibility studies. Allow sufficient time for proper planning, design, information documentation and tender submission. This helps to avoid errors and omissions that consequently help in avoiding or minimizing cost overrun; and
- ii. Pay progress payment to contractors on time because it affects the contractors' ability to finance the work since most contracting companies in the West Bank are small in size with a lack of capital; and
- iii. Check for resources and capabilities before awarding the contract to the lowest bidder and improve the prequalification standards; and
- iv. Detailed and comprehensive site investigation should be done at the design phase to avoid variations and late changes during the construction phase; and
- v. Better communication and coordination with other construction parties (consultants and contractors) to take the required decisions on time.

Contractors should consider the following:

- i. Enough and skilled staff should be involved in the construction projects, especially in large size projects; and
- ii. A more significant percentage of skilled labourers should be assigned and be motivated to improve productivity; and
- iii. Contractors should manage their financial resources and plan cash flow by utilizing progress payment; and
- iv. Provide sufficient number of equipment and try to invest in more reliable pieces of equipment (i.e., new equipment); and
- v. Better communication and coordination with other construction parties (consultants and owner), so the objectives could be achieved at the specified time, cost and quality.

Consultants should look to the following:

- i. Provide comprehensive information required for a more straightforward interpretation of the drawings and setting out of the works; and
- ii. Specifications should also be standardized as much as possible for ease of understanding by project participants; and
- iii. Ensure that adequate and realistic specifications of materials and methods are stated in the contract documents.

## **RECOMMENDATIONS**

- i. The construction parties should pay attention to improve contract standards to fit with Palestinian market conditions;
- ii. Improve systems for regulating time due to changes in quantities

### Further studies

- Similar studies can be done for other specific types of construction projects, such as utility projects, highway construction project, and dam construction projects. Detailed studies can be done to evaluate the involvement and effect of a specific party or resource of a construction project on the time and cost overrun in construction projects.
- Detailed studies, using field data, can be conducted to investigate the relationship between cost overrun and top affecting factors concluded in this study, i.e., study the relationship between cost overrun and experience in the contract. Another study is possible to determine the relationship between cost overrun and material waste on site.

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