Critical Cost Overrun Factors and its Controlling Measures in Construction Sector of Pakistan

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Abstract

Construction projects facing cost overrun is a common problem in developing countries, including Pakistan. This research paper identifies the major cost overrun factors faced by construction projects in Pakistan and also provides recommendations to reduce the cost overrun. To main objectives of this research is to identify the critical cost overrun factors and its controlling measures. To attain objectives, the first in-depth literature review was conducted, which helped to identify 33 common cost overrun factors. Secondly, a structured questionnaire was established among stakeholders of the construction sector to share feedback about the critical cost overrun factors. Results showed that stakeholders of construction projects (consultant, contractor, and client) have a different perception of cost overrun. After identification of major cost overrun factors, interviews were carried among mostly experienced stakeholders for mitigation and control measures. This research delivers a better understanding of major cost overrun factors. Also, it provides recommendations to stakeholders of construction projects as well as other professionals of Pakistan to control cost overrun.

Keywords—Cost overrun, Controlling measures, Construction sector

1 Introduction

THE construction industry is known as a very famous industry among all industries, which contributes about 9% of GDP (Gross Domestic Product) and also 6% of the employment in Pakistan [1]. Pakistan is known as a developing country due to the complex nature of construction industry. Pakistan is facing many challenges of time overrun, cost overrun, quality standards and poor management in the construction sector [2]. Although, due to advanced technologies in this sector, cost overrun is a severe and critical issue throughout the world [3]. For example, 90% of the projects of Uganda had faced the issue of cost overrun [4]. However, according to Ojo et. al. [5], almost all types of construction projects of Qatar are affected by

the cost overrun.

Rahman et. al. [6] concluded that 8 out of 10 construction projects of Malaysia had cost overrun of an average of 50% and above. A study carried by Narayanan et. al. [7] states that on average the mega construction projects in India cost more than 35% higher than the total cost of the project which was set initially. According to Khabisi et. al. [8], only 29% of the construction projects of South Africa were completed on the approved budget of the project. However, Amri and Marey-Perez [9] state that almost more than 60% of construction projects of Oman had faced cost overrun. Present studies has exposed the issue of cost overrun in all over the world. Construction sector of Pakistan is facing the critical cost overrun issues since last decades which has affected the economy of Pakistan [10]. It has been observed that many construction projects has faced cost overrun more than 50% from its original approved cost. Pakistan construction sector is

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severely affected from the serious and critical issue of cost overrun which has caused negative impact on the construction stakeholders [11].

A lot of research has been conducted to identify the factors of cost overrun in different construction projects including Pakistan, but smaller number of studies have been conducted on controlling the factors or causes of critical factors of cost overrun. However, this research has two objectives: one is the identification of critical cost overrun factors, and second is the determination of controlling measures of critical cost overrun factors.

2 Literature Review

A wide variety of research has been conducted on causes of cost overrun in construction projects. Wanjari and Dobariya [12] identified the main factors leading to cost overrun in Indian construction projects by conducting a survey. They identified thirteen cost overrun factors. Findings of the survey showed that the main cost overrun factors had cost escalation of construction items, delay in the planning of different phases of construction, coordination among stakeholders of the project, no proper planning of the project, changes in the scope of the project and submission of the redesign of the project. Khabisi et. al. [8] found the most important factors insisting cost overrun in the construction sector of South Africa, namely: variation in orders, cash flow problems, changes and variation in scope of the selected project, delay in making decisions, frequent changes in design, poor planning, improper coordination among parties, and accepting lowest rate tender policy. Akinradewo and Aigbavboa [13] specified the main causes of cost overrun in the construction sector of Nigeria by surveying construction stakeholders. The research outcomes presented that the main cost overrun causes were frequent changes in design, delayed payment to suppliers, improper project management, lack of coordination among construction stakeholders involved in the project, and incompetent additional cost (e.g., variations), poor financial control on-site, contract management, previous experience of the contractor, and wrong estimation method.

Albhaisi et. al. [14] surveyed the critical factors which contribute to cost overrun in Qatar construction projects. Interviews were carried out among 97 construction experts of mega running projects. The outcomes of the interviews exposed that critical cost overrun factors were changed in scope by the client, complex nature of design, client involvement in the design, lack of advanced machinery and safety conditions at site changes. In Vietnam, Kim et. al. [15] conducted

a study for the determination of factors leading to cost overrun in the construction sector. A questionnaire was distributed among contractors, client and consultants. The survey revealed that crucial cost overrun factors add work to a contractor, cost of material and its improper order, price inflation, delay in estimation and improper designing. Tadewos and Patel [16] carried research on the main cost overrun factors in road projects of Ethiopia. Outcomes of the research highlighted financial issues, land acquisition issues, inadequate planning, delay in supply of materials by contractor, inadequate design and poor management in Australia as the major contributors to cost overrun. Shah et. al. [17] determined the causative cost overrun factors in large construction projects by using a quantitative method. Results of the study revealed that causative and critical cost overrun factors were poor planning and monitoring, construction method, poor monitoring by consultant and fluctuation in materials price. Johnson and Babu [18] explored the severe factors of cost overrun in all construction projects in the United Arab Emirates. The research identified that five major cost overrun factors were design changes, mistakes in cost estimation, delay in deciding by the client, financial controls by the client and unsuitable method of procurement. Haslinda et. al. [19] conducted research on the main factors which contribute to cost overrun in construction projects of Penang in Malaysia by floating a questionnaire among construction stakeholders. The survey showed that the main cost overrun factors were inaccurate cost estimation, cost inflation, sparse pre-construction budget estimation and inaccurate quality standards.

Shaikh et. al. [20] carried a study on the major causes of cost overrun and time overrun by using structured and semi-structured interviews among experts of construction sector. The research showed that slow payment, financial issues and design changes were major causes of cost and time overrun.

The literature review helped to identify 33 main cost overrun factors in construction sector/construction industry as mentioned in Table 1.

3 Research Methodology

To achieve the main objectives of this research, a mixed-mode approach (a combination of qualitative and quantitative approach) was used. A comprehensive literature review was conducted on construction cost overrun, which concluded thirty three common cost overrun factors in construction projects. The recognized common cost overrun factors were used to develop a questionnaire. The developed questionnaire

No	Factors	Ref	No	Factors	Ref	No	Factors	Ref
01	Late in making the decision	[1]	12	Poor site supervision and management	[10]	23	Inadequate experience of designers	[10]
02	Deviations in the scope of projects	[21]	13	Delayed payment to suppliers by contractors	[21]	24	Problems in contract management	[8]
03	Late in payment from owner/client	[10]	14	Poor project management	[8]	25	Labour issues	[21]
04	Poor coordination between stakeholders	[1]	15	Delay in materials delivery	[1]	26	Inflation in the market	[10]
05	Delay in approval of design documents	[20]	16	Shortage of required materials	[20]	27	Floods and Rains	[1]
06	Frequent changes in design by the client	[10]	17	Uncertainty at site	[21]	28	Shortage of skillful labor	[20]
07	Impractical project schedule	[12]	18	Slow permits by local authorities	[8]	29	Remote construction area	[12]
08	Inexperienced contractor	[21]	19	Lack of advanced equipment and machinery	[10]	30	Incomplete design and drawings at the time of tender	[21]
09	Poor management by the contractor at site	[1]	20	Incompetency of consultant	[13]	31	Transfer of funds from one project to another project	[20]
10	Financial challenges and crisis faced by the contractor	[12]	21	Budget issues faced by the client	[1]	32	Inadequate planning	[13]
11	Variation in materials price	[21]	22	Inexperience sub-contractor	[21]	33	Client interruption during construction	[1]

TABLE 1: List of common factors

has two portions: Portion A and Portion B. Portion A was designed to get demography of the respondents. Whereas, portion B comprised the common construction cost overrun factors. For determination of the level of significance for cost overrun, a five-point Likert Scale was used. Likert scale was designed with values such that 5 indicates “highly contributing”, 4 indicates “very contributing”, 3 indicates “moderately contributing”, 2 indicates “slightly contributing”, and 1 indicates “ex-tremely not contributing”.

To know the relevancy of cost overrun in the construction sector of Pakistan, a pilot study was conducted among forty highly qualified and experienced stakeholders. Ullah et. al. [21] suggested the cut-off value for relevancy of cost overrun, as presented in Table 2. After analysis of the pilot study, the factors whose value were above 3.0 were known relevant to the construction sector of Pakistan. After conducting a pilot study, the developed questionnaire sets were distributed among 180 stakeholders of Pakistan construction sector. A total of 132 questionnaires sets were received back from selected stakeholders, from which 124 were considered as a valid response. 73% was the response rate for the conducted survey. The demography of the selected stakeholders for the conducted surveys is presented in Figure 1 and 2. SPSS Statistics is a software package used for interactive or batched statistical analysis. SPSS software was used for analysis of the collected data. Ranking of the cost

Mean value	Level of Relevancy
3.0 and above	Relevant
Less than 3.0	Not Relevant

TABLE 2: Cutoff value

overrun factors is done with mean value.

For determination of mitigation and control measures of identified main cost overrun factors, interviews and discussions were carried out with selected stakeholders and experts of the construction sector of Pakistan. The digital voice recorder was used to record the interviews of the selected stakeholders. Afterwards, NVivo software was used to analysis the collected data. The comprehensive demography of interviewees is shown in Table 3.

4 Data Analysis & Discussion

Following sections present the results of our analysis.

4.1 Main Cost Overrun Factors

In this research, SPSS Version 23.0 was used for data analysis. To check the reliability and consistency of the data, the value of Cronbach’s alpha was checked. According to Bhandari et. al. [22], the value of Cronbach’s alpha should be more than 0.7. In this research, the value of Cronbach’s alpha is greater than 0.7, which indicates that the collected data of the survey is

Position	Association/ Organization	Total Experience
Chief Resident Engineer	Consultant/ Designer	27 years
General Manager	Client/ Owner	27 years
Resident Engineer	Consultant/ Designer	25 years
Resident Engineer	Consultant/ Designer	25 years
Project Director	Client/Owner	25 years
Construction Manager	Consultant/ Builder	24 years
Project Manager	Consultant/ Builder	24 years
Design Engineer	Consultant/ Designer	22 years
Project Manager	Consultant/ Builder	22 years
Project Director	Client/ Owner	20 years
Construction Manager	Consultant/ Builder	20 years
Resident Engineer	Consultant/ Designer	19 years
Director	Client/Owner	19 years
The Engineer	Consultant/ Designer	18 years
Project Manager	Consultant/ Builder	17 years
Project Director	Client/ Owner	17 years
Construction Manager	Consultant/ Builder	16 years
Project Coordinator	Client/ Owner	16 years
Deputy Project Manager	Consultant/ Builder	15 years
Project Engineer	Client/Owner	15 years

TABLE 3: Demography of Interviewees

Fig. 1: Response of each stakeholder

Fig. 2: Working experience of stakeholders

accurate and valid. According to Sohu et. al. [23], the factors or causes having score more than 3.6 can be considered as critical factor. Factors that have mean value greater than 3.6 were selected as major cost overrun factors. The mean value of each major factor contributing to cost overrun in the construction sector is shown in Table 4.

4.2 Mitigation and Controlling Measures for Major Cost Overrun Factors

Following are the results of the questionnaire survey, mitigation and control measures of major 11 cost overrun factors explored by conduction interviews from construction stakeholders having expertise on dealing with mega projects. Table 5 shows the mitigation and controlling measures for major 11 cost overrun factors recognized through analysis of data using famous software known as NVivo. The results of the survey determined major 11 cost overrun factors in Pakistan’s construction sector. Table 4 shows “Financial challenges and crisis faced by the contractor” found as the first major factor of cost overrun with the maximum mean value of 4.721. It is also determined that “frequent changes in design by the client” and “deviations in the scope of projects” was found to be second and third most cost overrun factor with the mean value of 4.637 and 4.561 respectively. “Inflation in the market” was classified as fourth major cost overrun factor with the mean value of 4.398. However, “transfer of funds from one project to another project” was rated as fifth major cost overrun factor in Pakistan construction sector.

Mitigation and control measures for major 11 cost

Major Factors	Mean Value	Ranking
Financial challenges and crisis faced by the contractor	4.721	01
Frequent changes in design by the client	4.637	02
Deviations in the scope of projects	4.561	03
Inflation in the market	4.398	04
Transfer of funds from one project to another project	4.231	05
Impractical project schedule	4.169	06
Delay in approval of design documents	4.066	07
Poor coordination between stakeholders	3.974	08
Variation in materials price	3.894	09
Inadequate planning	3.803	10
Poor management by the contractor at site	3.729	11
Resident Engineer	Consultant/ Designer	19 years
Director	Client/Owner	19 years
The Engineer	Consultant/ Designer	18 years
Project Manager	Consultant/ Builder	17 years
Project Director	Client/ Owner	17 years
Construction Manager	Consultant/ Builder	16 years
Project Coordinator	Client/ Owner	16 years
Deputy Project Manager	Consultant/ Builder	15 years
Project Engineer	Client/Owner	15 years

TABLE 4: Ranking of major cost overrun factors

overrun factors were determined by conducting interviews from construction stakeholders. The number of mitigation and control measures was determined for each major cost overrun factor. For major cost overrun factor financial challenges and crisis faced by the contractor” the mitigation and controlling recommendation were “project contract should be awarded to financially strong contractor “funds should be released on time to the contractor”, “client should expedite the process of payment to the contractor” and “political interruption should be avoided in the project”. Likewise, for the second major cost overrun factor “frequent changes in design by the client”, the mitigation and controlling measures were “proper investigation should be made on-site”, “expert team of designing should be hired” and “consultant should be appointed on basis of expertise”. Each critical factor of cost overrun has strategy of controlling factors by using implementation of suggested measures.

5 Conclusion

The construction sector is facing problem of cost overrun since many decades. The impact of this cost overrun leads to slowing down the final completion of construction projects. The changes in cost overruns causes both project management and technical related issues. Cost overrun has badly affected the performance of the construction sector which puts negative affect on the stakeholders of this sector. The main purpose of this research is to identify the critical factors which causes cost overrun in construction sector and also determination of measures for identified critical cost

overrun factors. 11 critical factors were identified from total 33 common factors of cost overrun. This research also helps in determination of controlling measures of the critical factors of cost overrun and can be useful for construction stakeholders in Pakistan.

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Major Factors	Controlling and mitigation measure	Ranking
Financial challenges and crisis faced by the contractor	1. A project contract should be awarded to Financially strong contractor. 2. Funds should be released on time to the contractor 3. The client should expedite the process of payment to the contractor 4. Political interruption should be avoided in the project	01
Frequent changes in design by the client	1. A proper investigation should be made on site 2. An expert team of designing should be hired 3. The consultant should be appointed based on expertise	02
Deviations in the scope of projects	1. The political interruption should be avoided 2. The proper scope of the project should be defined in the initial stage 3. The regular meeting should be arranged with stakeholders	03
Inflation in the market	1. The material should be ordered in bulk 2. Domestic material should be used in the project 3. The client should make an agreement with contractor about fix rate of the materials.	04
Transfer of funds from one project to another project	1. Involvement of the political parties in the project should be restricted 2. Top management of the project should not be changed frequently 3. Sufficient allocation of funds should be reserved for each project	05
Impractical project schedule	1. A proper schedule of the project should be decided by the stakeholders 2. The construction site should be visited by the stakeholders 3. The competent team should be hired by the client	06
Delay in approval of design documents	1. Meetings should be arranged on a regularly basis 2. Proper documentation should be made for approval 3. Site conditions should be presented to competent authorities	07
Poor coordination between stakeholders	1. A mechanism should be decided for regular meetings 2. Stakeholders of the project should arrange seminars	08
Incompetent sub-contractor	1. Extremely experienced sub-contractor should be selected 2. Quality of the sub-contractor should be monitored 3. Selection of subcontractor on his previous history	09
Inadequate planning	1. The client should make a strategy before starting the project 2. Before tendering, site visits should be done by all stakeholders of the project 3. All stakeholders should be taken in confidence before any decision of the project	10
Poor management by the contractor at site	1. The unforeseen condition should be analyzed 2. An experienced team should be appointed by the contractor 3. Monitoring should be done by the consultant staff	11
Resident Engineer	Consultant/ Designer	19 years
Director	Client/Owner	19 years
The Engineer	Consultant/ Designer	18 years
Project Manager	Consultant/ Builder	17 years
Project Director	Client/ Owner	17 years
Construction Manager	Consultant/ Builder	16 years
Project Coordinator	Client/ Owner	16 years
Deputy Project Manager	Consultant/ Builder	15 years
Project Engineer	Client/Owner	15 years

TABLE 5: Mitigation and controlling measures for major cost overrun factors

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