

A study of the causes of cost overrun in construction industry in Afghanistan

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Abstract— *Cost overrun is a major problem in the construction industry which needs to be tackled for a cost-effective project. This study investigated the cost performance in construction projects of Afghanistan in order to identify the causes of cost overrun and their implications. A quantitative survey was performed for the targeted respondents namely client, contractor and consultant's representative involved in building construction projects in Afghanistan. A total of 104 responses were collected from 150 sets of a questionnaire distributed. The respondents were asked to rate the listed causes on the basis of probability of occurrence and severity of the impact. The questionnaire was then analyzed and the causes were categorized in 6 different groups and then ranked according to the degree of importance as assessed by the responses given by the target population. The findings of the study revealed that the majority of cost overrun factors with rating 6 out of 10 lie in medium severity impact zone. Results indicated that the major contributors to poor cost performance include external and material issues that have been elaborately discussed in this work.*

Keywords : *Construction projects, cost overrun, causes, Afghanistan*

I. INTRODUCTION

Construction industry forms a significant part of developed as well as developing countries' economic output and is one of the major sources of economic growth. The growing rate of cost overrun and delays in the delivery of construction projects are the major criticism which the world construction industries are facing (Enshassi et al., 2003). The construction projects usually present the cost overrun which is considered as a critical issue as the cost overrun represent a loss of finances for the contractors and owners. The construction sector in Afghanistan holds the highest amount of private sector investment and has been the major driving force behind Afghanistan's recovery. The construction activities have great significance in achieving Afghanistan's socio-economic development which includes roads, highways, power systems, airports, townships, buildings and houses, urban infrastructure, schools, hospitals, offices, etc (Ghiorgis, 2014). Despite the fact that the construction industry is an integral part of Afghanistan's national economy and its significant performance, the industry faces a considerable number of challenges and the construction performance and improvement have been underestimated. There are several factors which are responsible for the cost overruns. However, construction projects are said to be successful if the main factors that contribute to cost overrun are identified and examined before hand so that the professionals can learn from the historical data. Furthermore, it is essential for the identified major causes to look at the cost control measures that the professionals in the construction industry can apply to minimize the reoccurrence of the construction cost overrun.

Thus, this research study attempts to identify the major causes of cost overrun in Afghanistan construction industry that can be tackled at appropriate levels for improving the productivity of construction industry.

II. LITERATURE REVIEW

There are many factors that are influencing project cost over the time span between project initiation and completion of the project. Each cause has a contrasting impact on the project cost at project completion. In the past several decades, construction industries of many countries have faced the issue of cost overrun, though it is commonly acknowledged, the causes subject to more debate. The most important problem which led to the construction cost overrun in developing countries are fluctuations and increases in material price. Although all the factors are not similar to every project but most factors such as poor management, inaccurate material estimates and financial status of the contractor are common to the projects in the developing countries (Ahady et al., 2017). A number of factors are responsible for the poor cost performance and increases in the cost of the construction in Afghanistan. As reported by SIGAR (2010), Kabul power plant's final project costs had risen to approximately \$300 million of which \$40 million was directly linked to project delays. Factors contributing to such delays include lack of onsite quality assurance, poor planning, and implementation, subcontractor performance problems such as the inability to find enough qualified workers to keep the project on schedule, poor communication, transportation and customs clearance problems. Another report indicated that Afghan Ministry of Defense headquarters in Kabul had actually costed three times the original estimated cost. The building price tag which was initially set at \$48.7 million, cost 154.7\$ million. The reason behind this huge cost overrun was the problems associated with the contract from the outset the cost mushroomed and the project delay (SIGAR, 2016).

Numerous researches have outlined the issue of cost performance of the construction projects worldwide. In a study in Saudi Arabia undertaken by Al Gwaiz et al. (2006) found various factors by interviewing different professionals involved in the projects at various

stages. The researchers reported that changes in design and duration of the contract are the most influential cost factors. Contractors considered local laws and regulations, project planning and scheduling as the most influential cost factor while the developers regarded on-site disputes as the most influential cost factor followed by work experience. In the same context, Alghonamy (2015) found that the cost overrun causes in construction projects from contractors' point of view were bid award for the lowest price, repeated changes in the design, inaccurate planning, long time gap between design and time of implementation, and delays in payments. The statistical analysis clearly revealed that the data had exceptional consistency along with the agreement between the respondents on the asperity and repetitiveness of occurrence of the identified cost overrun causes.

A study carried out by Saraf (2013) discussed the most significant factors agreed by the owners, contractors, and engineers. The result showed that the main factors affecting the performance of construction projects are improper planning, inaccurate designing, site management, decision making, construction methods, lack of labor and technical personnel, construction mistakes and defective work, quality and shortage of materials and productivity.

Subramani et al. (2014) studied cost overrun in construction projects in India, where the researchers found that 'slow decision making' was ranked to have the highest influence, and making it the most significant cause of cost overrun whereas from consultant's point of view, 'poor design/delay in providing design' was ranked first in the level of importance. It was also first in terms of influence on the cost. Since the accountability of providing the design lies with the consultants themselves, the high ranking suggested that the consultants acknowledge a crucial section in project management. 'Poor schedule management' was ranked 2nd in terms of importance and was 1st along with the rise in material/machine prices in occurrence. 'Poor schedule management' was ranked similarly high with similar importance by clients. The most important cause according to contractors was 'non-performance of subcontractors' but it was ranked relatively less by both clients and consultants, because eventually, the contractors have to bear the authority for it. 'Increase in material/machine prices' was also ranked high by both clients and consultant.

Rauzana (2016) carried out a research to study the cost overruns and failure in construction projects in Indonesia. The researchers revealed that there were three main factors causing cost overruns viz. estimated costs, implementation and working relationships and the project documents.

Another study was conducted by Belachew (2017) to identify the causes of cost overrun in Federal Road Projects of Ethiopia. According to the research, the degree of cost overrun among selected project lengthened from 4.16% to 83.2%. the average magnitude of cost overrun was nearly 21.52% based on the three major construction parties (client, consultant, and contractor) and the principal factors that affect project cost performance were investigated. Lack of training, benefit realization and production supports were the primary reason for cost overrun at the execution processes of the projects as per clients' perception while lack of training, implementation process or bureaucrat and benefits realization were the primary reason for cost overrun at the execution processes as per contractors' perception.

III. RESEARCH METHODOLOGY AND DATA ANALYSIS

In this study, the questionnaire was developed in which the causes of cost overrun were first identified and then examined through a related literature review. This was followed by conducting a pilot study that sought advice from professionals and construction practitioners.

A triangulation research method was adopted including both qualitative and quantitative studies. For each of the variables that cause cost overrun, respondents were requested to indicate the severity or the degree of impact. To determine the relative importance of parameters contributing to causes of the cost overrun statistical package for the social sciences (SPSS) had been used. The quantitative method was used as the major statistical component to retrieve qualitative data through a self-administered questionnaire by Afghan construction experts. To achieve the required no. of respondents for significant statistical analysis, a comprehensive sampling strategy was used. These included questionnaire distribution to the target groups through cooperation with the local professional institutes of the respectively defined professions and construction-related contracting associations in Afghanistan. In order to achieve predictably, representative and strong quantitative data, the questionnaires were distributed and shared among construction professionals at various positions i.e. contractor, consultant, a client who are currently working in different types of building construction projects.

A total of 150 questionnaire sets were aimed to be distributed to individuals; i.e., 50 professionals working for the client, 50 for consultants and 50 for contractors out of which one hundred and four respondents took part from different professional backgrounds. There were thirty-five representing engineering consultants, thirty representing clients and thirty-nine contractors who responded to the survey and presented their views on the issue of cost overrun in construction projects.

Analysis of the data had been undertaken using the statistical methods. The analysis illustrates the findings and results of the survey for the severity and also for the six major categories of causes of cost overrun for the construction industry in Afghanistan.

The construction field surveyed were involve building projects with the majority of respondent 29.8% involved in offices or commercial building, 22.1% residential buildings, 12.5% Health and educational buildings, 9.6 % Hotel and Motel construction, 1.9% industrial construction and 11.5 % other types of construction include military buildings. Through the survey it was researched that 78.8 % of respondent's organizations were private, while 16.3 % were public and 4.8 % both.

The collected data were analyzed with the help of descriptive and inferential tools of the statistical software i.e. Statistical Package for Social Science (SPSS 24). The descriptive methods used were mean, median and standard deviations.

Before analyzing the data, the Cronbach's alpha test was used to check reliability statistics of variables where reliability ranges from 0 to 1. The reliability of a scale is strongly dependent on the number of items comprising the scale. If the scale is long enough, even items with poor internal consistency may have a reliable scale (Decoster and Claypool, 2004).

The Cronbach's alpha is mathematically written as:

$$\alpha = \frac{N \cdot \bar{C}}{\bar{V} + (N - 1) \cdot \bar{C}}$$

where,

N= the number of items,

\bar{C} = average covariance between item pairs

\bar{V} = average variance

Normally, the range of Cronbach's coefficient alpha value is between 0.0 and + 1.0. Higher the values of Cronbach's coefficient alpha, higher will be the degree of internal consistency. Table 1 presents the rule interpretation of Cronbach's Alpha (George and Mallery, 2003).

Table 1: Interpretation of Cronbach's Alpha coefficient (George and Mallery, 2003)

Cronbach's Alpha	Interpretation
$\alpha > 0.9$	Excellent
$\alpha > 0.8$	Good
$\alpha > 0.7$	Acceptable
$\alpha > 0.6$	Questionable
$\alpha > 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Also, to check whether the data was normally distributed or not, normality test was performed. To test the hypothesis and to determine the agreement of ranks among the respondents' groups Kendall coefficient of concordance (W) was used.

At the last stage, non-parametric tests were used to check correlation of each group and individual variables.

IV. RESULTS AND DISCUSSION

Sixty selected factors were listed in six categories and most of them had distinct effect on each method.

A. Design related factors

Most of the design factors have a high impact on cost overrun and ranked according to their importance. Eight key causes were addressed in this area through enough research and it has been concluded that the most important factors in this group are "Lack of pre-contract project co-ordination" ranked number one in the group with mean value of 3.61 and "improvement to standard drawing during construction stage" ranked to be number two with mean value of 3.52. This result is justified as the designers and managers should have a proper coordination before the bidding process and also any alteration of drawings and specification during construction and execution requires additional time for adjustments of resources. The lowest ranking with number 8 in this specific group was identified as "incomplete design at the time of tender" with a mean value of 2.51.

Table 2: Design related factors causing cost overrun

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Lack of pre-contract project co-ordination	3.61	1.13	1
Improvements to standard drawings during the construction stage	3.52	1.22	2
Inadequate planning	3.16	1.20	3
Inadequate review	3.07	1.10	4
Design change	3.03	1.19	5
Prior proper survey of the land when construction has to be done	2.84	1.06	6
Design failures in different phases	2.77	1.15	7
Incomplete design in the time of tender	2.51	1.36	8

B. Management related factors

Seventeen key causes were analyzed in this area. The most important factors in this group were "Quantity underestimation/overestimation" ranked 1st with a mean value of 3.25 and "poor contractor management" ranked in position 2 with a mean value of 3.16. The lowest ranking with number seventeen in this specific group came as "change in legislation" with a mean value of 1.89.

Table 3: Management related factors causing cost overrun

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Quantity underestimation /overestimation	3.25	1.19	1
Poor contractor management	3.16	1.27	2
Changes in specifications and material types during construction	3.05	1.10	3
Delays in issuing information to the contractor during construction stage	3.03	1.12	4
Delays of Inspection	2.90	1.20	5
Lack of cost reports during construction stage	2.86	1.20	6
Omissions and errors in the bills of quantities	2.85	1.11	7
Contractual claims such as extension of time with cost claims	2.83	1.20	8
Absenteeism at worksite	2.74	1.26	9
Inadequate construction safety	2.72	1.18	10
Lake of communication	2.71	1.28	11
Lack of experience of project type	2.56	1.19	12
Project size	2.54	1.29	13
Logistics due to site location	2.53	1.31	14
Delay in final account agreements	2.44	1.36	15
Delay in resolving disputes	2.19	1.42	16
Change in legislation	1.89	1.37	17

C. Material and equipment related factors

The results in Table 4 demonstrate eight key factors in the material and equipment group and were ranked according to their importance. It was evaluated that most important factor in this group “shortage of construction material required” ranked in position 1. This factor discovered as the most important factors affecting construction productivity in Indonesia (Kaming et al., 1997), Gaza strips (Enshassi et al., 2007) and Iran (Zakeri et al., 1996). The result also indicated that “delay in material delivery” are not considered to be as important as other factors and were ranked at position 8 in this specific group came as with a mean value of 2.58.

Table 4: Material and equipment related factors causing cost overrun

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Shortage of supply of construction material required	3.69	1.04	1
Fluctuations in the cost of building materials and other materials	3.68	1.20	2
Low quality of raw materials	3.44	1.31	3
Wastage of material	2.95	1.26	4
Lack of equipment required	2.94	1.21	5
Non-working of equipment leading to wastage of time	2.88	1.18	6
Equipment operators skill level is Low	2.81	1.24	7
Delay in material delivery	2.58	1.28	8

D. Labor related factors

Ten key causes were highlighted in this group. It was revealed that the most important factor in this group is “lack of skilled labor” ranked to be number one 1 in the group with a mean value of 3.572 and lowest ranking with number 10 in this specific group was found to be “increase in laborer age” with a mean value of 2.196. It was noteworthy that the construction industry has young age labor but inexperienced with low technical skills which is a big issue in the construction industry.

Table 5: Labor-related factors causing cost overrun

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Lack of skilled labor	3.57	1.31	1
Labour unrest	3.49	1.20	2
Inadequate & insufficient skill of labour	3.48	1.16	3
Lack of training	3.07	1.31	4
Lack of safety measures taken by labor.	2.56	1.24	5
Lake of motivation in labors	2.50	1.33	6
Difficulties in monthly payments from agencies	2.40	1.39	7
Inadequate living condition for labour	2.356	1.22	8
Labour cost increased due to environment restrictions	2.353	1.28	9

Increase in labourer age	2.19	1.41	10
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E. Client, consultant, and contractor related factors

Nine key causes were highlighted in this group from the literature review and related context. It was found that the most important factor in this group is “delay in sub-contractor work” ranked as number one with a mean value of 3.67 and lowest ranking with number nine given to “delay in construction, supply of equipment by contractors” with a mean value of 2.61.

Table 6: Client, consultant, and contractor related factors

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Delay in sub-contractors work	3.67	1.45	1
Poor qualification of consultant	2.92	1.32	2
Contractor's unstable financial background	2.86	1.16	3
Suspension of work by client	2.83	1.16	4
Changes due to client requirement.	2.80	1.21	5
Late instruction by consultant	2.74	1.18	6
Poor communication among the consultant and other parties	2.69	1.24	7
Failure to apply safety rules and regulation within the contractor's organization	2.63	1.19	8
Delay in construction, supply of equipment by contractors	2.61	1.22	9

F. External factors

Some cost overrun factors such as unanticipated events are unavoidable and cannot be reasonably prevented. However, cost overruns due to some external problems are avoidable because they could have been foreseen and prevented. Eight key causes were pointed out in this group. It was noted that the most important factor in this group is “market inflation /deflation” which is ranked number one with a mean value of 3.72 and the lowest ranking with number eight in this specific group was “work suspended due to security reason” with a mean value of 2.57.

Table 7: External factors causing cost overrun

Descriptive Statistics			
Factors	Mean	Std. Deviation	Rank
Market inflation/deflation	3.72	1.27	1
Corruption	3.70	1.21	2
Unpredictable weather condition	2.91	1.15	3
Access to utilities (Electricity, Water)	2.89	1.29	4
Security problems	2.87	1.26	5
Manmade disaster (bomb blasting , accident)	2.81	1.22	6
Natural disaster (floods, hurricane)	2.63	1.27	7
Works suspended due to security reasons	2.57	1.15	8

The result of respondents rating indicates that mentioned causes of cost overrun may be deemed to be more of a major factor than minor.

G. Ranking groups negatively affecting the project cost

In this section, a brief summary of the analysis of groups that causes cost overrun in projects has been mentioned. There were six groups that caused cost overrun that have been categorized. Table 8 represents the ranking groups negatively affecting the project cost.

Table 8. Ranking groups negatively affecting the project cost

Factors Group	Mean	Std. Deviation	Rank
External factors	3.72	1.27	1
Material related factor	3.69	1.04	2
Client, contractor, consultant related factors	3.67	1.45	3
Design related factors	3.61	1.13	4
Labor related factors	3.57	1.31	5
Management related factors	3.25	1.19	6

Fig.1 represents ranking the groups that negatively affecting project cost by their mean and std. deviation values.

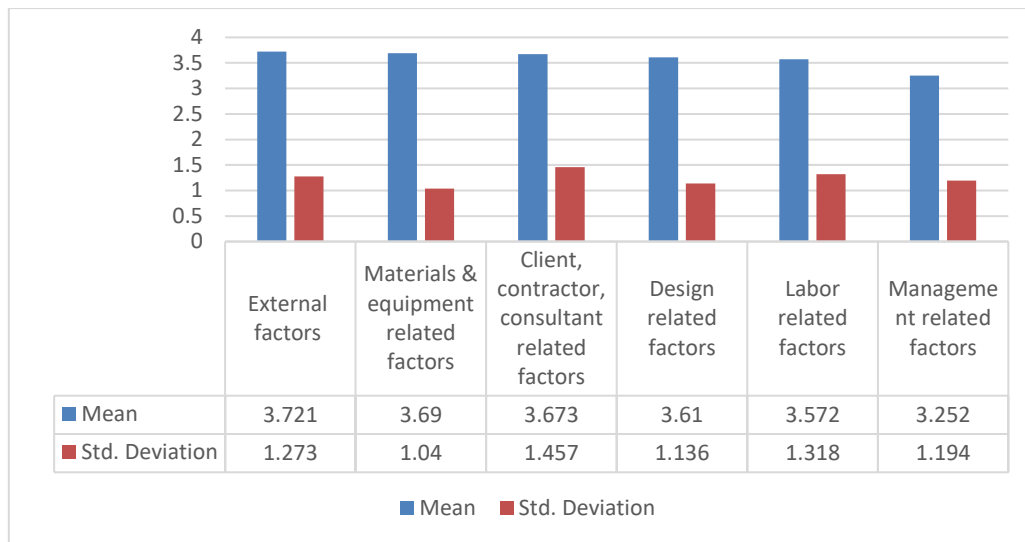


Fig 1. Ranking groups negatively affecting project cost

According to concordance test, the value of W for rankings of causes of cost overrun was found to be 0.198. The results are shown in Table 9. As per the result of the analysis, the p values was found to be less than 0.05, hence this verifies that the null hypothesis where “there is no agreement among the sets of rankings groups has to be rejected. Subsequently, the alternative hypothesis; i.e., “there is agreement among the sets of rankings groups” is supported with a confidence level of more than 95%.

Table 9: Coefficient of Concordance and significance level of causes of cost overrun

Test Statistics	
Kendall's W ^a	0.198
p value	0.0000000029

H. Top 10 factors caused cost overrun

Top ten causes of cost overrun are listed based on the ranking of their average mean values and presented in Table 10. It is observed that the most frequent causes of cost overrun as per survey were “Market inflation/deflation” as 1st followed by “Corruption” as 2nd which falls in the range of high as per the assessment scale. Further, it is reported that “Shortage of supply of construction material required” is 3rd, “Fluctuations in the cost of building and other materials” is ranked 4th, “Delay in subcontractor's work” as 5th which is again with mean values of more than moderate and very close to high. Likewise, “Lack of pre-contract project coordination” is ranked 6th, “Lack of Skilled Labor” at 7th position, “Improvements to standard drawings during construction stage” as 8th, “Labour unrest” as 9th and “Inadequate & Insufficient skill of labor” is at the 10th position. It is also observed that there is not much difference in the mean values of most variables. The causes and their mean values have calculated, analyzed and are listed below.

Table 10: Top 10 factors causing cost overrun

Causes	Mean	Std. Deviation	Rank
Market inflation/deflation	3.72	1.27	2
Corruption	3.70	1.38	6
Shortage of supply of construction material required	3.69	1.04	3
Fluctuations in the cost of building and other materials.	3.68	1.20	4
Delay in sub-contractors work	3.67	1.45	5
lack of pre-contract project coordination	3.61	1.13	6
Lack of skilled labor	3.57	1.31	7
Improvements to standard drawings during construction stage	3.52	1.22	8
Labour unrest	3.49	1.20	9
Inadequate & insufficient skill of labour	3.48	1.16	10

According to Spearman and Pearson concordance test results, the correlation score between variables of all groups is above 0.01 which means there is a high correlation among the variables. Therefore, the data was found to be highly consistent and reliable.

V. CONCLUSION

This research attempted to investigate the cost overrun problems particularly for building construction projects in Afghanistan. The probable reasons of cost overrun in building construction in Afghanistan were reviewed through the literature assessment and a random sampling of the respondents was made and following conclusions from the study were drawn:

- To check the reliability and the inner consistency of variables and to make sure for the acceptance of data, Cronbach's alpha test was used and was found to be 0.96 which is above 0.7 that indicates the high reliability of variables.
- According to Kendall coefficient of concordance, the results were found to be having strong agreement among the rankings.
- With regard to cost overrun variables, the 10 most important factors were identified from each set of ranks. Based on the outcome of results the top ten reasons of causes of cost overrun were found to be: 1st causes fall in the External related group which is "market inflation/deflation". 2nd "corruption" which is the result of more than 2-decade war in Afghanistan and remain uncontrolled succeed by 3rd "shortage of supply of construction material required" which shows the construction material which is required for making good quality building is rarely available in Afghanistan, 4th is "fluctuations in the cost of building materials and other materials", 5th falls in contractors related group which is "delay in subcontractor's work", 6th is management related factor that is "lack of pre-contract project ordination" which indicate that fast-track bidding process is not beneficial for the projects, 7th labor related factor which is a big need in Afghan construction industry that is "lack of skilled labour", 8th design related factor that is "improvements to standard drawings during construction stage", 9th "labour unrest" which is lead to low quality work and rework, 10th "inadequate & insufficient skill of labour" which is labor related group causing cost overrun.
- The results of the external group showed that it is the greatest source of project cost overrun as it is highly ranked by all respondent and parties. It is concluded that the causes of cost overrun fall mostly into the external, contractors, management and material related groups, which are seemingly involved in cost performance of any construction projects.
- The study also identified the frequency of experience of cost overruns in the construction projects in Afghanistan and the survey result indicated that 6 out of 10 projects fall into this category.

VI. RECOMMENDATIONS

The problems of cost overrun are affecting the construction industry in Afghanistan. All stakeholders should work together to achieve successful projects within the stipulated budget, and exceed the anticipated quality standard.

The academicians can concentrate on more specific and detailed studies on the causes of cost overrun and its effects. Conflict and corruption are important interrelated challenges which affected the construction industry in Afghanistan. The government and the related sector should be deeply committed to rooting out corruption to end the culture of impunity. This can be achieved through increasing the use of electronic payments and e-procurement.

In order to minimize the incidences of cost overruns in building construction projects construction managers should:

- Set performance requirements for selecting project participants' i.e. competent consultants and well performing and reliable contractors.
- Main stakeholders should uptake full responsibility in their field of work and should coordinate and undertake actions wisely on the acknowledged top ten reasons to evade cost overrun in projects.
- Maximize the resource efficiency through procurement of labor, materials, and equipment.
- Implementation of knowledge sharing and knowledge management.
- Monitoring risk and respond to events that occur over the course of the project by updating risk management plans with new information.
- For successful completion of the construction project, the project management skills can be utilized by the practitioners and executors to mitigate the identified causes of cost overruns.
- The construction contractors should have sufficient knowledge and be professionals in the field and have the adequate experience in the type of construction projects. Moreover, human resources should be well-trained in managerial as well as technical aspects of the construction.
- Resolving security challenges will require political negotiations and military success.

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