

Causative factors of cost overrun in highway projects of Sindh province of Pakistan

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Abstract. Cost overrun is an increase of cost of project from approved budget which was signed by parties at the time of tender. Cost overrun in construction of highway projects is a common problem worldwide and construction industry of Pakistan is also facing this crucial problem of cost overrun in highway projects of Pakistan. The main objective of this research is to identify the causative factors of cost overrun in highway projects of Sindh province of Pakistan. A well designed questionnaire was developed based on 64 common factors of cost overrun from literature review. Developed questionnaire was distributed among selected 30 experts from owner/client, designer/consultant and contractor who have experience more than 20 years' experience in highway projects. The collected data was statistical analyzed. After analysis results showed that delay process in payment by client, inadequate planning, client interference, poor contract management, delay of decision making, change of scope of project and financial problems faced by client were most causative factors of cost overrun in highway projects. This research will provide alertness to stakeholders of highway projects of Sindh province to avoid cost overrun in projects.

1. Introduction

Construction industry is developing in developed and developing countries all over the world is [1]. Construction industry plays an important role in the growth of economy of the any country, furthermore it is proved that it is facing many challenges and issues, from others cost overrun or budget overrun is one of the critical issue [2]. Through the project management life cycle of construction projects, cost is known as most important consideration as well as the main one of the most significant parameters for measuring achievement of construction projects [3]. According to Agren *et al* [4] that cost overrun is a crucial problem globally and that many projects are not completed within the approved cost and budget of the project. Cost overrun is a critical issue in construction industry which causes disputes between client, contractor and consultant [5]. Like developing countries Pakistan is also facing the critical cost overrun problem where the cost of the projects exceeds up to 100 % of actual cost of the project. Many factors like cash flow problem faced by contractor and inadequate planning leads to delay and stopping of construction activities at site which causes cost overrun [6].



2. Cost overrun

Cost overrun can be defined as cost of any project is increased from the actual and approved cost of the project [7]. Cost overrun can be known as budget overrun where the final cost of the project exceeds the approved and original cost of the project [8]. Cost overrun can also be defined as the change between the original budget and estimated budget as a percentage of the estimated budget, with all budget calculated in constant prices [9]. Cost overrun is a change of initially approved cost and the final cost of the completed project [5].

3. Previous Research

In Pakistan, many researches have been conducted to identify major and critical factors cost overrun or budget overrun in construction industry. A study carried by Chouhadary *et al* [10] in which major factors of cost overrun or cost increase in construction industry of Pakistan were found. From his study most causative factors of cost increase and cost overrun. From his study most causative factors of cost increase were errors and mistakes in design and drawings, inaccurate cost and time estimates, cash flow problem faced by client and contractor, variations in materials price and inadequate planning. Another study carried by Azhar *et al* [6] in which most critical factors which causes cost overrun were identified by using quantitative method from stakeholders of construction industry. Most critical factors of cost increase were fluctuation or change in material prices, machinery maintenance cost, bidding process at lower rate, delay in approval of drawings, mistakes in cost estimates, addition works by contractors and sudden changes and adequate planning by government. Furthermore, another study carried Ejaz *et al* [11] regarding critical and causative factors of cost increase or cost overrun. Results of study showed that bidding on lower rate, delay process of payment to contractor, shortage of materials, poor cost control, delay in approvals and rework at site were the causative and critical factors of cost increase or cost overrun.

4. Research procedure

In this research quantitative method is adopted to understand the opinion of construction stakeholders towards factors contributing cost overrun in construction of highway projects in Sindh province of Pakistan. In this regard, investigation was made up in two phases. First phase included literature work and conducting interviews. From this phase 64 factors of cost overrun were identified. In second phase part a questionnaire was developed which comprises of two stages. Stage A includes demography of the respondents (experience, biodata, qualification, contact details), stage B includes factors of cost overrun in construction industry. Each respondents were asked to rank and score factor according to their knowledge.

5. Data collection and analysis

In this research a questionnaire was established and designed on likert scale. Likert scale indicate the statement of the respondent is asked and to calculate according to subjective or objective criteria; mostly level of disagreement and agreement is measured. The designed questionnaire of five ordinal actions of Likert scale from one (1) to five (5) according to level of a contribution. Each scale indicates the resulting score:

- (5) = Very high Effective
- (4) = High effective;
- (3) = Medium effective;
- (2) = Low effective; and
- (1) = Very low effective

Designed questionnaire was distributed hand to hand among 30 respondents of having more than 20 years' experience in construction of highway projects in Sindh province. Reliability test was conducted to check the reliability of gathered data by using SPSS 20. For this Cronbach's alpha was calculated and value of Cronbach's alpha was 0.874. According to Yuan *et al* [12] that if the value of

Cronbach's alpha is more than 0.7 to 1 is acceptable and less than 0.7 is not acceptable. Ranking of the factors was accord to mean value from the response of each respondents. Higher value indicates the maximum value of cost overrun factor. In order to find the causative factor of cost overrun mean value of each factor is calculated.

6. Results and discussions

Table 1 shows the results of analysis of each factor with score. Based on results of survey for each factor, the factors whose mean score above than 4.6 were selected as causative factors of cost overrun in construction of highway projects. after analysis of results shows that financial delay in process payment by owner/client, inadequate planning, owner/client interference, poor contract management delay in decision making, laws and regulations frame work, change in scope of project, financial difficulties faced by Owner/Client and policy bidding tender to the lowest price with their mean value 4.90, 4.668, 4.667, 4.651, 4.644, 4.633, 4.621, and 4.618 respectively are the causative factors of cost overrun in construction of highway projects in Sindh province of Pakistan as shown in table 2.

6.1 Delay in process payment by owner/client

Delay in progress payment by owner/client was most causative factor with mean value 4.90. Mostly owner/client delay the payment process to the contractors and with this the construction activities at site mostly stop and causes the cost overrun and time overrun respectively. For the small, medium and large scale owners delay in payment may cause unpredicted events. Construction of highway projects is too expensive for one owner to complete the project without continuous flow of payment [13].

6.2 Inadequate planning

Inadequate planning was found common problem in construction of highway projects which causes cost overrun problem. Overlooking the ground conditions leads to cost overrun of project. Inadequate planning by client and contractor in project also leads the cost overrun in project [14]. Inadequate planning of the project creates problem of cost overrun because so many activities are involved in construction phase. Due to inadequate planning, project comes with cost overrun problem [14].

6.3 Owner/client interference

Owner/client is the main player of the project and interference of owner/client can changes many things in construction of project. Survey results showed that factor interference by owner/ client causes cost overrun in highway. Owner/client interference like changes in key posts and appointment of contractor on his own selection causes cost overrun or sometimes changes in policies and approval and delays in construction activities also causes cost overrun [15].

6.4 Poor contract management

Poor contract management is also one of causative factor of cost overruns in highway projects which is mostly causes cost overruns when project is given on not clear and well understood. Mostly projects are not clear and contractor perspective is not clear about contract document which mostly causes cost overrun [16].

6.5 Delay in decision making

Delay in decision making is one common factor with high mean value which causes cost overrun in construction of highway projects. Delay in taking decision is mostly on part of client and consultant, many construction activities remain stopped until final decision. Because of not frequent meetings and other parameters causes factor delay in decision making [17].

6.6 Laws and regulations frame work

Law and regulations frame work is a causative and critical factor of cost overrun in construction of highway projects. Because of not clear and general policies of projects contractor faces problem is execution which causes cost overrun in every stage of execution [18].

Table 1. Critical factors with score.

S.No	Factor	Score	S.No	Factor	Score
01	Delay in process payment by owner/Client	4.9000	31	Additional works	3.6200
02	Inadequate planning	4.6681	32	Schedule delay	3.6100
03	Owner/Client interference	4.6673	33	Mistakes and discrepancies in contract document	3.6010
04	Poor contract management	4.6510	34	Contractual procedure and type of contract	3.6000
05	Delay in decision making	4.6443	35	Omissions and errors in the bills of quantities	3.5667
06	Laws and regulations frame work	4.6333	36	Impractical and complicated design	3.5666
07	Change in scope of project	4.6213	37	Social and cultural impacts	3.5333
08	Financial difficulties faced by Owner/Client	4.6180	38	Rework	3.5233
09	Policy bidding tender to the lowest price	4.596	39	Delay payment to supplier/subcontractor	3.5313
10	Lack of experience	4.5900	40	Limited range of supplier	3.5033
11	Shortage of skilled labour	4.5667	41	Poor project management	3.5003
12	Unsuitable construction methods	4.5333	42	Incompetent subcontractor	3.5133
13	Late delivery of equipment's	4.5000	43	High cost of machinery and its maintenance	3.5033
14	Shortage of workers	4.5000	44	Fraudulent procedures and kickboards	3.5011
15	Poor site management	4.4667	45	Problem with neighbors	3.4667
16	Cash flow and financial difficulties faced by contractor	4.4667	46	Waste on sites	3.4657
17	Frequent design changes	4.4667	47	Relationship between labour and management	3.4333
18	Inaccurate time and cost estimates	4.3667	48	Inadequate modern equipment	3.4113
19	Quality assurance control	4.3667	49	Contractual claims, such as, extension of time with cost claims	3.4100
20	Late delivery of materials	4.3333	50	Inaccurate quantity take-off	3.4000
21	Shortage of materials	4.2667	51	Problem with neighbors	3.3667
22	Fluctuations of price of materials	4.2333	52	Waste on site	3.3657
23	Slow information between parties	4.1667	53	High cost of labor	3.3467
24	Inadequate monitoring and control	4.0000	54	Disputes between management	3.335
25	Approval of drawings	3.9000	55	Delay in approval of Completed works	3.333
26	Delay in material procurement	3.8667	56	In adequate monitoring	3.333
27	Quality of materials	3.8333	57	Inadequate new equipment	3.267
28	Bureaucracy in tendering document	3.7333	58	Incompetent subcontractors	3.267
29	Number of construction projects going on at same time	3.7000	59	Low labour productivity	3.267
30	Disputes on site	3.6667	60	Poor cost control at site	3.067
61	Poor project management	3.033	62	Lack of communication	3.033
63	Inaccurate site investigation	2.900	64	Complicated design	2.871

Table 2. Causative factors of cost overrun in construction of projects in Sindh province of Pakistan.

Factor	Mean Value	Rank
Delay in process payment by owner/client	4.900	1
Inadequate planning	4.668	2
Owner/Client interference	4.667	3
Poor contract management	4.651	4
Delay in decision making	4.644	5
Laws and regulations frame work	4.633	6
Change in scope of project	4.621	7
Financial difficulties faced by owner/client	4.618	8

6.7 Change in scope of project

Change in scope of project can change many construction activities. Mostly client or owner changes the scope of project by influencing of politicians or sometimes initial stage the scope of project is not clear. If the scope of the construction project is changed which leads to increase in cost of the project [19].

6.8 Financial difficulties faced by owner/client

Financial difficulties faced by owner are most common and causative factor found in construction of highway projects in Sindh province. Mostly funds of projects are transferred to other projects. Mostly projects are facing problem of cost overrun because of financial difficulties faced by owner/client [20].

7. Conclusion

This study found that cost overrun is a major and important issue in construction of highway projects of Sindh province. Total 64 factors were found from deep literature review. After analysis the factors whose mean value was above 4.6 were found as causative factors. Most causative factors of cost overrun were Delay in Process payment by owner/client, inadequate planning, Owner/Client interference, Poor contract management, Delay in decision making, Laws and regulations frame work, Change in scope of project and financial difficulties faced by owner/client in construction of highway projects in Sindh province. The results of this research will not only be beneficial in controlling cost overrun in construction of highway projects but it will also help in the improve the environment in construction industry of Pakistan.

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