

Identification and Analysis of Critical Risk Factors Responsible for Cost Overrun in Highway Projects of North India

Varun Kumar Sharma^a, Pardeep Kumar Gupta^b, R.K.Khitoliya^c

^a Ph.D Research Scholar, Punjab Engineering College (Deemed to be University), Chandigarh, 160012, India

^b Professor, Punjab Engineering College (Deemed to be University), Chandigarh, 160012, India

^c Professor, Punjab Engineering College (Deemed to be University), Chandigarh, 160012, India

Abstract: Cost overrun is a typical issue worldwide when it comes to development of highway ventures and the highway industry of India is likewise confronting this vital issue. To beat this issue, the principle goal of this paper is expected to distinguish the critical factors responsible for cost overrun in highway projects in the regions of Northern India (Chandigarh, Delhi, Punjab and Haryana) and to recommend the conceivable measures to limit it. A well planned questionnaire for survey was created dependent upon literature review and interviews with the accomplished people in the field of highway ventures. After various considerations, 38 cost overrun causing factors were included in the questionnaire. Developed questionnaire was distributed among 120 engineers, having vast experience. The collected data was statistically analyzed. After analysis results showed that design changes, land acquisition, escalation in price of raw material, conflict/lack of co-ordination between construction parties, delays in shifting existing utilities, constructability issues and poor financial control were most critical factors responsible for cost overrun in highway projects. This investigation will provide awareness, mindfulness and attentiveness among the stakeholders of highway projects to keep the projects away from cost overruns.

Keywords: Cost Overrun, Critical Risk Factors, Highway Construction, Mean Value (M.V), Relative Importance Index (R.I.I), Representative R.I.I.

1. Introduction

Construction industry has turned into an imperative player and is crucial for the monetary improvement of any nation, especially the developing nations. In developing nations this industry experiences various issues that influence the performances in terms of cost, time and quality. Successful completion of construction ventures within the predetermined tender cost has turned into a tough task. It has become phenomenal that a venture is finished well inside the contracted budget, assessed time and specified quality. Proper management of the capital involved in construction is a vital undertaking for the fruitful consummation of any project. Most of the time, it is not possible to accomplish good management of capital involved in project and as its consequence, the project experiences a significant amount of overrun in terms of cost. Effective cost planning relates the structure to its cost, along with taking full

consideration of its quality, its proper utility and the involved risks. The overall cost expense is expected to be within the monetary limits.

Cost overrun can also be understood as the proportion of the difference between actual cost which may be defined as the cost determined at the completion of the project and initial cost which is the original estimated cost [1]. In relative terms cost overrun may be computed in a percentage value and it can be obtained using equation as shown in Eq. 1.

$$\text{Cost overrun (\%)} = \frac{[\text{Actual cost at completion of project} - \text{Original estimated cost}] \times 100}{\text{Original estimated cost}} \quad (1)$$

2. Literature Survey

Cost overrun in construction enterprises is a worldwide phenomenon; however the circumstance may or may not differ from country to country. The variety is influenced by various variables dependent on the economical conditions, geographical conditions and the prevailing environment for construction in the country. Some of these factors could be grouped under complexities in construction, presence of more number of stakeholders, construction materials and equipments related factors, climatic conditions, political conditions, human resources and so forth. In a study by Ibrahim et al [2] it was reported that the cost of the project is the budgeted expenditure, which the client agrees to commit in creating or acquiring the desired construction facility. Cost overrun is the difference between the actual final cost of a construction venture at consummation and the contracted amount, concurred by the stakeholders during the signing of the contract agreement. Cost overrun is also called cost increase, cost escalation or budget overrun. One of the main considerations for a successfully accomplishing a project is completing the project under considered budget [3]. Besides, cost execution strategies are the key estimation of organizations efficiency and benefit [4]. Project cost overrun is the contrast between the estimated cost during planning stage and the genuine cost occurred on completion of the project. The construction industries in India are commonly unable to finish the projects under the first evaluated expense [5]. A number of examinations have been performed which led to deal with the issues and concerned factors that are responsible for cost overrun in highway projects. An examination by Flyvbjerg et al. [3] uncovered that out of 10 construction ventures 9 ventures experienced cost overrun with an average cost overrun of about 28%. Another examination led by Cantarelli et al. [6] demonstrated that cost overrun is a typical issue in construction ventures, which scrutinized 87 projects and established that there were more than 8 e projects which confronted cost overruns.

In India, an examination driven by Iyer and Jha [5] represented ten basic elements prompting cost overrun. To be specific clash among members of the venture, ignorance to past experience, lesser learning required for the project, poor project attributes, non- existence of cooperation, hostile socio-economic situations, climatic conditions, hesitance hampering timely decision, forceful challenge at tendering stage and short offered planning time. In Saudi Arabia an examination dependent on construction industries demonstrated that the major factors that provoked cost invades were the financial dependability, effects of climatic conditions, location of the venture, absence of efficiency norms, socio-cultural impacts, control

of the suppliers, deficient in raw material, lastly absence of construction cost information [7]. An investigation in the Gaza Strip on cost overruns revealed the critical causes being lack of construction material, fluctuation in the price of materials, late procurement and availability of materials and equipment, differentiation of currency prices, poor control of cost, additional works, poor executives at site, poor correspondence and coordination between stakeholders, delay in payment as per the progress, inadequate planning and scheduling, venture complexities, mistakes in configuration records and delays in obtaining approval for structure endorsement [8]. In Nigeria, the key explanations behind cost overruns in infrastructure projects are: poor executives, material deficiency, value variation, frequent change in design, financing, late issuing of installments and climate conditions [9]. An investigation on Ghana ground water ventures recognized that the five primary cost overrun factors are poor contractor management, material procurement, difficulty in payment on monthly basis from agencies, poor technical performances, and escalation of material prices [10]. Another investigation conducted by Le-Hoai et al. [11] considering construction projects of Vietnam found that the vital components that realized cost invade incorporate troubles in financing the ventures by the project owner and contractor, change in configuration of designs, poor project management and poor supervision on site and increment in cost of labor wages. An exploration was completed by Kaming et al. [12] focusing for recognizing the huge cost overrun factors. The outcomes showed that the key factors are the degree of project complexity, material cost increments because of inflation and inaccurate materials estimation.

Based upon the above literature surveys and interviews held with the experts of the field the most commonly occurring factors responsible for cost overruns along with their codes used in analysis are tabulated in Table 1. These factors were also considered in the formulation of questionnaire survey used in this study.

3. Methodology

In this exploration work quantitative methodology is adopted to comprehend the point of view of construction stakeholders towards components adding to cost invade in construction and development of highways in the regions of northern India (Chandigarh, Delhi, Punjab and Haryana). In this context, study was conducted in two stages. The first stage was emphasized over extensive literature survey work and conducting interviews with the expertise of the field. As a result from this stage, 38 factors of cost overrun were identified as tabulated in Table 1 and were used in questionnaire. In the second stage questionnaire survey was performed. The questionnaire comprises of two parts Part A and Part B. Part A comprises of the general particulars of the respondents (name, email-id, contact info, educational qualification, company name, position and working experience), and Part B is focused upon factors responsible for cost overruns occurring in different phases of highway project life. In this respondents were asked to rank these risk factors leading to cost overruns based upon the frequency of occurrence and the severity of these risk factors according to their own judgment and local working experience.

4. Data collection and analysis

For carrying on this research work a questionnaire was established which was designed on likert scale. A draft questionnaire was discussed with the local experts in highway construction to evaluate the content of the questionnaire. Modifications and changes were incorporated accordingly. For each cause a question was designed: What is the degree of severity of this cause on project cost overrun? The severity was categorized on a five-point scale as follows: very low, low, moderate, high, and very high on a 1 to 5 point scale respectively. Designed questionnaire was distributed using Google Forms and also hand to hand among 120 respondents having considerable experience in construction of highway projects. Total of 92 responses were received back and considered for evaluation. The reliability of collected data was evaluated using SPSS. The Cronbach's alpha value for the considered data came to be 0.874. According to Yuan et al. [13] the reliability of data is accepted if the value of Cronbach's alpha is lying between 0.7 to 1 and is not acceptable in case the value is less than 0.7. Ranking of the factors was adopted on the basis of R.I.I (Relative Importance Index) value calculated from the response of each respondent. Higher value of R.I.I for any cost overrun factor indicates it is critical in comparison to other factor with lower value of R.I.I. In order to find the critical factors of cost overrun, R.I.I value of each factor is calculated. Mathematically Cronbach's alpha value and R.I.I value is computed using Eq.2 and Eq.3 respectively.

$$\alpha = N.c / [v+(N-1)c] \quad (2)$$

Where, α is Cronbach's Alpha

c = Average inter-item covariance among the items

N = Number of items

v = Average variance

$$\text{R.I.I Value} = \sum W / (H \times N) \quad (3)$$

Where, R.I.I is Relative Importance Index

H = Highest Ranking Available

N = Total Number of respondents who answered the question

$\sum W$ = The total weight given to each factor by the respondents which ranges from 1 to 5

4.1 Factors responsible for cost overrun.

Factors used in questionnaire survey, along with their codes are tabulated below in Table 1.

Table 1. Factors Responsible for Cost Overrun in Highway Projects Used in Questionnaire Survey

S.No	Code Used	Cost Overrun Factors	S.No	Code Used	Cost Overrun Factors
1	CO1	Escalation in price of raw material	9	CO9	Dispute while settlement and clearance of bills
2	CO2	Land Acquisition	10	CO10	Ambiguous or incomplete tender document
3	CO3	Delay of existing network schedule	11	CO11	Shorting of contract period
4	CO4	Conflict/Lack of co-ordination between construction parties	12	CO12	High quality work expectation from owner
5	CO5	Additional works	13	CO13	Fraudulent practices and kick backs
6	CO6	Design Changes	14	CO14	Construction mistakes
7	CO7	Poor financial control	15	CO15	Management at site level and labour relation
8	CO8	On site wastage	16	CO16	Act of god

S.No	Code Used	Cost Overrun Factors	S.No	Code Used	Cost Overrun Factors
17	CO17	Delays in shifting existing utilities	28	CO28	Dependencies on other department (railways, electricity board etc)
18	CO18	Lack of ownership of the equipments	29	CO29	Improper interpretation of Contract and specification.
19	CO19	Poor Procurement strategies	30	CO30	Dependency on imported materials.
20	CO20	Non availability of raw material	31	CO31	Organizational Failures
21	CO21	Increased or unstable interest rates	32	CO32	Unrealistic work schedule
22	CO22	Change is rules and regulations or policies by the Government	33	CO33	Poor workmanship & Unskilled labour force
23	CO23	Inefficient/Inaccurate estimation during tendering	34	CO34	Late issuing of approved documents
24	CO24	Project delivery system	35	CO35	Constructability issues (construction under limited area, construction under traffic, right of way)
25	CO25	Inefficient utilization of resources	36	CO36	Inaccurate Feasibility report
26	CO26	Labour strikes	37	CO37	Political Issues, Social Issues, Public Agitation.
27	CO27	Negligence in learning from Past Experiences	38	CO38	Negligence of site visit

4.2 R.I.I Value of top 16 cost overrun causing factors.

The R.I.I Value, based upon Eq.3 was computed for each of these 38 factors responsible for cost overrun. After obtaining the R.I.I Value of each factor, comparison of the R.I.I Value among all these 38 factors was done. The top 16 factors having maximum value of R.I.I in comparison to other factors were considered as the critical factors responsible for cost overrun in highway projects. The top 16 factors with their respective R.I.I Value and their ranking are shown in Table 2.

Table 2. Ranking of Top 16 Critical Factors Responsible for Cost Overrun in Highway Projects Based Upon R.I.I Value

S. No	Code Used	Cost Overrun Factors	R.I.I Value	Rank
1	CO6	Design Changes	0.86	1
2	CO2	Land Acquisition	0.83	2
3	CO1	Escalation in price of raw material	0.83	3
4	CO4	Conflict/Lack of co-ordination between construction parties	0.81	4
5	CO17	Delays in shifting existing utilities	0.80	5
6	CO35	Constructability issues (construction under limited area, construction under traffic, right of way)	0.77	6
7	CO7	Poor financial control	0.76	7
8	CO8	On site wastage	0.75	8
9	C10	Ambiguous or incomplete tender document	0.75	9
10	CO33	Poor workmanship & Unskilled labour force	0.74	10
11	CO36	Inaccurate Feasibility report	0.73	11
12	CO14	Construction mistakes	0.73	12
13	CO24	Project delivery system	0.72	13
14	CO22	Change is rules and regulations or policies by the Government	0.71	14
15	CO37	Political Issues, Social Issues, Public Agitation.	0.70	15
16	CO16	Act of god	0.70	16

4.3 Top 16 cost overrun factors based upon mean value

The ranking of the factors were again done on the basis of mean value method (M.V). The mean value for all the factors responsible for cost overrun were computed and the top 16 factors having maximum mean value were selected and tabulated in Table 3. Mean values were calculated for verifying the ranks obtained from relative importance index method. The mean value of the factors was computed using formula given in Eq.4.

$$M.V = \frac{\sum W}{N} \quad (4)$$

M.V is the mean value for the factor

$\sum W$ = The total weight given to each factor by the respondents which ranges from 1 to 5

N = Total Number of respondents who answered the question

List of critical cost overrun factors were selected according to their mean value (M.V). The top 16 factors were ranked accordingly having maximum mean value as shown below in Table. 3.

Table 3. Ranking of Top 16 Critical Factors Responsible for Cost Overrun in Highway Projects Based Upon Mean Value.

S. No	Code Used	Cost Overrun Factors	M.V	Rank
1	CO6	Design Changes	4.31	1
2	CO2	Land Acquisition	4.17	2
3	CO1	Escalation in price of raw material	4.15	3
4	CO4	Conflict/Lack of co-ordination between construction parties	4.05	4
5	CO17	Delays in shifting existing utilities	4.02	5
6	CO35	Constructability issues (construction under limited area, construction under traffic, right of way)	3.85	6
7	CO7	Poor financial control	3.82	7
8	CO8	On site wastage	3.75	8

S. No	Code Used	Cost Overrun Factors	M.V	Rank
9	C10	Ambiguous or incomplete tender document	3.73	9
10	CO33	Poor workmanship & Unskilled labour force	3.68	10
11	CO36	Inaccurate Feasibility report	3.65	11
12	CO14	Construction mistakes	3.63	12
13	CO24	Project Delivery System	3.62	13
14	CO22	Change in rules and regulations or policies by the Government	3.56	14
15	CO37	Political Issues, Social Issues, Public Agitation.	3.48	15
16	CO16	Act of god	3.48	16

5. Comparison of Results Obtained from R.I.I Value Method and M.V Method

It is observed that both methods Relative Importance Index and Mean Value used for analysis shows similar results as tabulated in Table. 4. And therefore it is concluded that the methods used for analyzing data are acceptable. The comparison was based upon the ranking achieved by each factor when both the methods were used.

Table 4. Comparison of rank of the top 16 critical cost overrun factors.

S. No	Code Used	Cost Overrun Factors	R.I.I Ranking	M.V Ranking
1	CO6	Design Changes	1	1
2	CO2	Land Acquisition	2	2
3	CO1	Escalation in price of raw material	3	3
4	CO4	Conflict/Lack of co-ordination between construction parties	4	4
5	CO17	Delays in shifting existing utilities	5	5

S. No	Code Used	Cost Overrun Factors	R.I.I Ranking	M.V Ranking
6	CO35	Constructability issues (construction under limited area, construction under traffic, right of way)	6	6
7	CO7	Poor financial control	7	7
8	CO8	On site wastage	8	8
9	C10	Ambiguous or incomplete tender document	9	9
10	CO33	Poor workmanship & Unskilled labour force	10	10
11	CO36	Inaccurate Feasibility report	11	11
12	CO14	Construction mistakes	12	12
13	CO24	Project delivery system	13	13
14	CO22	Change is rules and regulations or policies by the Government	14	14
15	CO37	Political Issues, Social Issues, Public agitation.	15	15
16	CO16	Act of god	16	16

6. Most Critical Factors Based Upon Representative R.I.I Value.

In this study we are using a five-point likert scale for representing the severity and probability of occurrence of factors as very low, low, moderate, high, and very high on a 1,2,3,4,5 point scale respectively as mentioned earlier. From this it is clear that the maximum possible R.I.I Value that could be attained by any of the considered 38 factors is 1 and the minimum R.I.I Value that could be obtained is 0.2. To understand then criticality of these factors among the considered 38 factors the Representative R.I.I Value for these factors were computed based upon the Eq.5. This is done in order to find out the most critical factors. The factors having Representative R.I.I Value equal to and above 70 were considered the most critical and are ranked accordingly in Table 5.

$$\text{Representative R.I.I Value} = \left[\frac{(R_f - r)}{(R_{\max} - r)} \right] \times 100 \quad (5)$$

Where, R_f is the Relative Importance Index (R.I.I) Value Of the considered factor

R_{\max} = Maximum possible value of R.I.I that could be achieved by any factor ($R_{\max} = 1$, in this case)

r = Minimum possible value of R.I.I that could be achieved by any factor ($r = 0.2$, in this case)

Table 5. Top 7 most critical factors based upon Representative R.I.I Value

S. No	Code Used	Cost Overrun Factors	Representative R.I.I Value	Ranking
1	CO6	Design Changes	82.69	1
2	CO2	Land Acquisition	79.23	2
3	CO1	Escalation in price of raw material	78.85	3
4	CO4	Conflict/Lack of co-ordination between construction parties	76.35	4
5	CO17	Delays in shifting existing utilities	75.58	5
6	CO35	Constructability issues (construction under limited area, construction under traffic, right of way)	71.15	6
7	CO7	Poor financial control	70.38	7

7. Results and Discussions

From the above shown top 16 critical cost overrun factors in Table 4, the top 7 most critical factors as shown in Table 5 have been analysed and discussed below. The Representative R.I.I Value of these seven factors was found to be maximum and above 70 in comparison to the other factors. So these seven factors must be given maximum concern in order to tackle the problem of cost overrun.

From, Table. 5, it is clear that design changes, ranks first among all the considered responsible factors. Designer's misinterpretation of data, carelessness, lack of technical knowledge, unaware of site conditions, lack of practical experiences, unaware of future needs are some of the causes for design changes. So proper planning, adequate investigation of site and accurate design procedure are needed to execute the project with high precision. So designer should possess some qualification and experience before he designs the projects. If the design stage is not carefully examined and properly monitored, it will make additional cost to rectify the errors.

Land acquisition is ranked second. Most of the road projects are kept aside and are delayed due to objections from owners of the land. In the present scenario many projects are sanctioned by the Government, but after that it is not even started due to land issues at the initial phase of the project itself. The impact of land issues are getting serious now a days. It not only causes delay but also causes overrun of cost in the project. Therefore it is essential to formulate a strategy to overcome the issue in the initial stage itself. So introducing a national policy, widely in the country and also amendment in the laws for land acquisitions are to be immediately implemented. Effective and timely plan and actions are needed to solve this problem in the earlier stages.

Escalation in the price of raw materials the third ranked cost overrun factor. It is caused due to policy changes by the government, changes in wages of labours working in extraction of raw materials, machinery cost used for extraction and other construction related activity cost. This price change is mainly due to inflation and it is one of the predominant factors for the cost overrun in highway projects. It seems there is no solution for this problem, but effective planning at the procurement stage will reduce the price escalation by a little amount. Use of standard cost escalation method in construction contracts at the contractual stage itself and providing provisions for contingencies in the contract, could also be useful in avoiding cost overrun.

Fourth ranked factor is Conflict/ Lack of co-ordination between construction parties. Various problems are evolved due to poor communication between parties. It is one of the dominant factors and the issues contributing to this factors might be, communication gap prevailing among the stakeholders of the project. Constituting an advisory body which deals with the issues such as resolving disagreement between stakeholders, early sanction of payments and taking initiatives for early decision making for the progress of the project would also play key role. Hence, it may be anticipated to have an additional body to take care of frequently occurring problems and which maintains healthy coordination between the stakeholders involved (client, consultant and contractor).

Delay in shifting existing utilities is considered at fifth rank of critical factors. Most of the road construction projects are started, before the utilities are relocated from the site. This is one of the unavoidable situations that cause delays in construction, which finally leads to overrun of cost. So it is necessary to plan the relocation process and schedule the projects according to that. It is the prime solution to avoid the cost overruns in the road projects.

Constructability issues have been ranked sixth in this study. This issue arises by various reasons such as constructability under traffic area or under restricted area. Due to this special care and special arrangements are to be made, which directly contributes to cost overrun. These special arrangements when not included might cause severe situation, accidental or fatal injuries to others on site which might lead to the stay on current project by the law and order authorities, causing excessive delays and expenditure on settlement of issue. This somehow shows the adverse effect on cost of project and leads to cost overrun. To overcome this it is essential to develop policies and team specifically to deal with the problem of constructability.

The problem of poor financial control ranks seven. This could occur by the negligence of both client and contractor. Withholding of payment by client and unauthorized claim by contractors leads to cost overrun of the project. To overcome this issue it is necessary to have proper monitoring, analysis and adjustment of project's cash flow.

8. Conclusions and Recommendations

8.1 Conclusions

Cost overrun are the most common factor and predominant in road construction projects in India. And during this study effort was taken to find out the most critical factor which was mostly influencing the highway projects in the region of northern India. So a questionnaire survey was performed across various Government and private organizations. From the study it was observed that many respondents mainly focused on completing the project within the budget to control the cost overrun. The predominant factors from the study, based on respondents perspective includes the issues of, Design Changes, Land Acquisition, Escalation In Price of Raw Material, Conflict/Lack Of Co-Ordination Between Construction Parties, Delays In Shifting Existing Utilities, Constructability Issues (construction under limited area, construction under traffic, right of way), Poor Financial Control, On Site Wastage, Ambiguous or Incomplete Tender Document, Poor Workmanship and Unskilled Labour Force, Inaccurate Feasibility Report, Construction Mistakes, Project Delivery System, Change in Rules And Regulations or Policies by The Government, Political Issues, Social Issues, Public Agitation, Act of God. To verify the accuracy of results made from the questionnaire survey, two different methods for analysis were used during the analysis of study and those methods are relative importance index value method (R.I.I), and mean value method (M.V). Both the methods used for analysis shows similar results in ranking of the critical factors and therefore it is concluded that the methods used for analyzing data are acceptable. The most critical factors amongst these dominating 16 factors were selected based upon their Representative R.I.I Value. Total of seven factors having Representative R.I.I Value above 70 were considered the most critical factors.

Following conclusions could be drawn based on study:

- i. From the opinion of respondents, it could be concluded that the top seven most critical factors affecting cost overruns are design changes, land acquisition, escalation in price of raw material, conflict/lack of co-ordination between construction parties, delays in shifting existing utilities, constructability issues (construction under limited area, construction under traffic, right of way), and poor financial control.
- ii. It is suggested to amend some improvisations to the price escalation clause. Since most of the professionals have the opinion that this clause completely removes the burden from the contractors as the escalation price is to be paid by the client. This causes less attention of the contractor towards the timely progress of the project. Hence certain amendments should be made in which both client and contractor should share risks equally in case of price escalation and other activities related to it.
- iii. In light of the investigation, it was proposed that client should solidify his prerequisite in the initial stage, adequate staff should be deployed, administrative and managerial level training to be given to the staff members to extemporize and take a shot at limiting time and cost in scheduled activities.
- iv. It is advisable to bring in action a new body called as ‘advisory body’ which acts as a client’s representative which would help to reduce conflicts between stakeholders and enable early decision making so that the progress of the project goes on as per the schedule.
- v. The invalid claim of contractors and withholding of payment by client, both the issues must be given serious attention as it indicates the problem of poor financial management and control.

8.2 Recommendations

- i. Design errors can be omitted by appointing an experienced person for the role of designer and gave sufficient time to prepare the design. A separate panel comprising of design professionals is to be made for cross checking and verifying of designs made by the designer. To avoid the design changes in construction stage, final approval of design is made before starting the work and getting authorization is also to be implemented.
- ii. Early identification of lands to be acquired is the best solution to avoid the land acquisition of the project. Because, about 70% of lands are acquired before the work gets started, balance 30% is acquired periodically after the commencement of work. This is the major reason for land acquisition issues. By forming a new team especially for land acquisition and providing training for key staff will avoid this issue.
- iii. Detailed work out of materials should be carried out based on the initial and reconnaissance survey will help in avoiding cost overrun due to critical issue of escalation in price of raw material. Non availability of construction material issue can be avoided by preplanned purchase strategy. It includes purchasing of unique and rarely available raw materials and stored it in site earlier, before the task starts. It is the prime solution for the cost overrun issue. A realistic cost escalation factor should be considered on project estimates and early predictions of escalation cost based on future value of money in project estimates are the best solution to avoid cost escalation problems.
- iv. In order to avoid conflict and losses due to communication gap between clients and contractors, it is advisable to have an additional body which connects client, consultant and contractor to take care of frequently occurring problems.
- v. After acquisition of land, the utilities removal plan is to be adopted at the pre-construction stage itself. Identify the scope of relocation with the help of support of utility authority is to be implemented to avoid cost overrun due to delay in shifting of utilities. Forming a committee inclusive of members from all departments in project is one of the solutions.
- vi. In order to avoid funding problems and payment delays, a realistic time period is mentioned in the contract, clearly indicating about time for the parties to prepare the claim and certification. Financial plan is also to be made that consist of date of disbursement and amount to be settled.
- vii. Act of God is an unavoidable situation which cannot be determined earlier. It seems there is no solution for that. But there is a possibility of making provisions in the contract document, indicating about this issue. So that it will resolve the problem to some extent. Allowance of extra payments and extra time are to be mentioned in the conditions of contract for tackling these types of disasters.
- viii. Sufficient time is to be given for preparing the tender and work out the quantities accurately after studying the tender document carefully, these are the powerful tool for avoiding the quantity increase in construction stages.
- ix. Unstable interest rates cannot be avoided fully but can be reduced. By providing a provision clearly in contract condition adjusted with floating rate of interest, will avoid the loss of money for the contractor.
- x. It is necessary to have proper monitoring, analysis and adjustment of project's cash flow to tackle down the proper of poor financial control.

References

- [1] D. C. Invernizzi, G. Locatelli, and N. Brookes, "Cost Overruns – Helping to Define What They Really Mean," in *Proceedings of the Institute of Civil Engineers*, 2017, pp. 1–6.
- [2] S. IBRAHIM, W. M, and W. SHAKANTU, "A conceptual Framework and Mathematical Equation for Managing Construction - Material Waste and Cost Overrun," *Int. J. Econ. Manag. Eng.*, vol. 10, no. 2, pp. 587–593, 2016.
- [3] B. Flyvbjerg, M. K. S. Holm, and S. L. Buhl, "What Causes Cost Overrun in Transport Infrastructure Projects?," *Transp. Rev. A Transnatl. Transdiscipl. J.*, vol. 24, no. 1, pp. 3–18, 2004.
- [4] Y. A. Olawale and M. Sun, "Cost and time control of construction projects : inhibiting factors and mitigating measures in practice," *Constr. Manag. Econ.*, vol. 28, no. 5, pp. 509–526, 2010.
- [5] K. C. Iyer and K. N. Jha, "PROJECT Factors affecting cost performance : evidence from Indian construction projects," *Int. J. Proj. Manag.*, vol. 23, no. 4, pp. 283–295, 2005.
- [6] C. C. Cantarelli, B. Flyvbjerg, B. Van Wee, and E. J. E. Molin, "Lock-in and its influence on the project performance of large-scale transportation infrastructure projects : investigating the way in which lock-in can emerge and affect cost overruns," *Environ. Plan. B Plan. Des.*, vol. 37, no. 5, pp. 792–807, 2010.
- [7] A. Bubshait and Y. Al-Juwairah, "Factors contributing to construction costs in Saudi Arabia," *Cost Eng.*, vol. 44, no. 5, pp. 30–34, 2002.
- [8] A. Enshassi, S. Mohamed, and S. Abushaban, "Factors affecting the performance of construction projects in the Gaza strip," *J. Civ. Eng. Manag.*, vol. 15, no. 3, pp. 269–280, 2009.
- [9] A. Omoregie and D. Radford, "Infrastructure Delays and Cost Escalation: Causes and Effects in Nigeria," in *Proceedings of the 6th International Postgraduate Research Conference in the Built and Human Environment*, 2006, pp. 79–93.
- [10] Y. Frimpong, J. Oluwoye, and L. Crawford, "Causes of delay and cost overruns in construction of groundwater projects in a developing countries ; Ghana as a case study," *Int. J. Proj. Manag.*, vol. 21, no. 5, pp. 321–326, 2003.
- [11] L. Le-hoai, Y. D. Lee, and J. Y. Lee, "Delay and Cost Overruns in Vietnam Large Construction Projects : A Comparison with Other Selected Countries," *KSCE J. Civ. Eng.*, vol. 12, no. 6, pp. 367–377, 2008.
- [12] P. F. Kaming, P. O. Olomolaiye, G. D. Holt, and F. C. Harris, "Factors influencing construction time and cost overruns on high-rise projects in Indonesia," *Constr. Manag. Econ.*, vol. 15, no. 1, pp. 83–94, 1997.
- [13] W. Yuan, C. Deng, H. Zhu, and J. Li, "The Statistical Analysis and Evaluation of Examination Results of Materials Research Methods Course," *Creat. Educ.*, vol. 3, no. 7, pp. 162–164, 2012.