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Study of Factors Causing Cost and Time Overrun in Construction Projects

Chhavi Gupta
Student of M. Tech In Construction Management ,
al-falah College Of Engineering. & Technology,
Faridabad, India ,

Chitranjan Kumar
Assistant Professor,
Al-falah College of Engineering. & Technology,
Faridabad, India

***Abstract*— In India, the construction site is the biggest economic industry. The most important factors in the success of project plans are timely completion and compliance with the assigned costs of each project. The main objectives of this analysis are to analyze the dominant causes of cost and time overruns and to identify feasible and realistic steps to reduce overruns in construction projects. A comprehensive literature review was conducted to identify the factors influencing construction time and cost overruns. Considering these factors a questionnaire was developed and sent to different owners, consultants and contractors to consider. Then the responses were assessed using Relative Importance Index method (RII) so as to rank the factors. The most significant factors of construction delays were identified as: Material selection and changes in types and specifications during construction; Poor maintenance of equipment; Shortage of construction materials; Financing between the owner and the contractor; Shortage of labor; and significant factors of cost overrun identified are 'Inflation and escalation of material price', 'Change in project by owner', 'High transportation cost', 'frequent breakdown of the construction plant and equipment' and 'rework due to errors during construction'.**

Keywords*— *Cost Overrun, Time overrun, Relative Importance Index.

1. INTRODUCTION

In the development of a country's economic growth, the construction industry plays a very important role.
It has been noted that the building structure industry has become one of the world's leading industries. The increasing complexity of the construction projects shows a greater demand on construction managers to deliver projects on time, within planned budget and with high quality. The major challenge faced by the construction industry in the developing countries is the chronic problem of cost and time overruns.
It is understandable that the construction industry has special features that do not usually happen in other industries. For instance, when conditions in the construction field changes to be more complex than what was anticipated in the planning and design phase, additional costs and time are needed. Creating large facilities takes a long time and usually absorbs a large amount of investment. Over time, the complexity of the project also increases, so the need for project manager is constantly increased in order to minimize the delay and cost for obtaining the quality work.

Cost overrun in projects

The basic component of every construction project is cost. Cost overruns are, however, one of the most commonly occurring problems in building projects worldwide and need to be further researched to mitigate this problem in the future. In developing countries, where such overruns often exceed 100% of the project's estimated cost, this pattern is more extreme.
A cost overrun, also known as a cost rise or budget overrun, entails unexpected costs incurred due to an underestimation of the actual cost during budgeting, in excess of the projected sum. According to a very detailed global construction research conducted by Flyvbjerg (2002), it was found that 9 out of 10 projects had cost overruns. A cost overrun is a major problem in both developed and developing countries. Hence, this problem is a critical factor to be studied to alleviate the issue in the future.

Time overrun in Projects

Delay is one of the most general, major and serious issues affecting the time factor in construction projects in civil engineering. Time overload is a crucial factor, even with technical advancements and improved understanding of project management by project managers, time overrun is a critical factor. The explanations for the delay in projects are different. Delays are caused by factors such as "postponement of material delivery to the site, malfunction of equipment, political problems, and several weather conditions. Delays in some circumstances make the situation much more difficult. Recognizing the delay causes and selecting precise and correct measures to minimize the detrimental effect of delays on the length of projects is important for a thorough evaluation.

2. LITERATURE REVIEW

Time and cost overruns are the most severe issues in the construction sector. In any construction project time and cost overruns exist and the severity of these varies considerably from project to project. In order to reduce and eliminate these overruns in any project, it is therefore important to identify the exact causes of time and cost overrun.

(Hatkar K B and Hedaoo N A, 2016) analyzed the literature and carried out questionnaire survey and identified that causes and effects behind the delays in construction projects are Local political interference; Delay in progress payments by client; Improper project planning and scheduling; Inadequate fund allocation; Escalation of material prices. Relative Importance Index (RII) was used to assess and rank the factors. He also used the Spearman's Rank Correlation Coefficient test to

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determine significant correlation between contractors and consultants perspective.

(U.Sindhu Vaardini, S.Karthiyayini, P.Ezhilmathi , 2016) analysed the various factors by using different methods (Frequency index method, Severity index method, Importance Index method and Relative Index method) by collecting questionnaires based on the previous studies. He identified that poor climatic planning and scheduling, lack of proper site management, fluctuations in the material rate, monitoring and controlling, improper management of resources in construction project and poor financial control in site can yield to cost overruns.

(Serdar Durdyev, Syuhaida Ismail and Nooh Abu Bakar, 2012) identified various factors for such overruns, by carrying out a descriptive survey in a typical developing country, Turkey and used Relative Importance Index method to analyse the data. The analysis of factors indicates that the main factors affecting cost overruns in the construction of residential projects of Turkey are, inappropriate project cost estimation, improper planning, and high cost of required resources, lack of skilled workforce, price of construction materials and high land prices.

(Aishwarya Prashant Patil, 2017) identified the factors which are responsible for time overrun based on perception of all three main parties of the contract namely contractor, consultant and client i.e Delay in payment, weather conditions, Inaccurate planning and scheduling of project by contractors, unexperienced technical staff of contractor, Excessive work in hand of Contractors, Shortage of labours, Delay in approving extra work and Poor site management and supervision of contractors, Ineffective time management.

(Ismail Abdul Rahman, Aftab Hameed Memon and Ahrnad Tarmizi Abd. Karim, 2013) identify the significant factors causing cost overrun in Malaysia by conducting questionnaire survey and analyzed the statistical data by using Relative Importance Index method (RII) for hierarchal assessment of factors and found that the top 3 most significant factors of cost overrun are cash flow and financial difficulties faced by contractors, fluctuation of prices of material, and poor site management and supervision.

(Ghaleb J. Sweis , Rateb Sweis , Malek Abu Rumman , Ruba Abu Hussein, Samer E. Dahiyat, 2013) identify factors influencing cost overruns in the Jordan public construction sector. After literature review, he classified several factors affecting cost overruns in building projects into: Material cost increase by inflation, Fuel cost increase, Design changes, Inaccurate quantity take off, Lack of experience in project location, Lack of experience in project type, Lack of experience in local regulations, Unpredictable weather conditions and Equipment shortage. Examined these cost overruns factors and ranked according to perceptions of 30 engineers working in the Jordanian public construction sector found that the Consequent the design changes, lack of experience of project type and location were extracted after treating the nine factors using PCFA analysis.

(Nabil Al-Hazim, Zaydoun Abu Salem, 2015) Analyzed many documents and reports of several projects and found that the most critical factors are: weather conditions, Terrain conditions, variation of order, and availability of labor.

(S. Shanmugapriya , Dr. K. Subramanian, 2013) researched important factors causing time and cost overruns in Indian projects, and carried out a questionnaire survey developed based on literature review and distributed to Contractors, Consultants, and Owners of Indian construction Industry. He analyzed the data from the questionnaire by using Relative important index method and found out that the major cause for time overruns are material market rate, contract adjustment, and high quality work requirement and the major key factors for cost overruns are high shipping cost, change in material specification, and escalation of materials price.

(Mr. Salim S. Mulla, Prof. Ashish P. Waghmare, 2015) identified that projects suffer due to the client's delay in providing some of the material that they have to deliver to the contractor as part of the contractual arrangement or delay in settling Running Account bills. These problems together with other problems such as delay in getting clearances and other problems listed above makes it more difficult to complete the project on time and within planned budget. Another challenge the construction industry faces is the low productivity of resources, especially equipment productivity.

(Anant Narayan Shete, Vaibhav Durwas Kothawade) Identified economic instability, political situation, material price fluctuation, competitors levels and currency exchange as the top five factors affecting cost overrun in construction projects.

(Vaibhav Y. Katre1, Dr. D.M. Ghaitidak) showed that one of the most significant factor that could lead to cost overrun was "delay in preliminary delivery of the site". The delay of material supply and equipment by the contractor; prices inflation significantly leads to cost overrun. "Low labour efficiency", "Delay in Bill payment", "Lack equipment maintenance", "inadequate procurement programming of materials, Strikes, protests and other external variables was the most critical factor that influence project delay.

(Aftab Hameed Memon , Ismail Abdul Rahman , Ade Asmi Abdul Azis) conducted a questionnaire survey and interviews were conducted for expert opinion among selected experienced workers to identify the significant factors causing cost overrun in Malaysia and the answers were evaluated by average index method that established 59 common factors causing cost overruns. Results shows that bad designs, design delays, unrealistic contract duration & requirements imposed, lack of experience, late delivery of materials & equipment, relationship between management & labour, delay preparation & approval of drawings, inadequate planning & scheduling, poor site management & supervision and mistakes during construction were most common and significant factors perceived by experts.

(Sunil A. Kage , Meghendra R. Mane, Arjun M. Chougule, Abhishek V.Kadam, Rushikesh S. Majale) discover the most influencing factors causing the project delay and cost overruns in three different regions in the country such as east region (West Bengal and Orissa State), south region (Karnataka and Tamilnadu State) and west region (Maharashtra and Gujarat State). Data from the past studies of each region was selected for analyses and the most influencing factors found were ; Lack of planning and scheduling, Ineffective monitoring and feedback process, Poor methods of construction, Underestimating of project cost, Delay in payment, Improper site management and Inadequate contractor experience.

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3. OBJECTIVE

Objectives of this research are:

- Track slippages in the actual time & cost schedule by contrasting the reasons behind the same time and cost schedule with the scheduled time and analysis.
- To investigate the reasons of cost and time overrun by conducting surveys in the form of questionnaire.
- To recognize the most significant factors impacting construction time and cost.
- To analyse and tabulate the reasons of delay and cost overrun through Relative mportance Index method.
- Suggest remedial steps in terms of modifying strategies, practices and procedures, organizational structure, contract agreement, policies, activities and procedures.

4. RESEARCH METHODOLOGY

The research methodology explains the approach followed for data collection, essential to accomplish the study target and objectives. It is divided into parts covering: formulating the study's goals, defining resource restriction factors and questionnaire architecture, gathering data using questionnaire survey, evaluating data by detailed statistical analysis, defining essential factors using Relative Importance Index System (RII), grouping factors (factor reduction) using the fact.

A comprehensive literature review was conducted to identify the factors influencing construction project cost and time overrun. In view of the factors affecting the cost and time overrun of construction projects in India, a survey questionnaire was built based on 33 time overrun factors and 20 cost overruns factors. A pilot study was conducted before the questionnaire was distributable. The fundamental purpose of the pilot study was to verify that the questionnaire was complete in capturing factors relevant to India. The questionnaire was distributed and the data was collected among construction professionals. These questionnaires were based on the Likert's scale of five ordinal measurements ranging from 1 to 5 (very low effect to very high effect) according to level of contribution amount.

5. DATA ANALYSIS

The procedure used in analyzing the data was aimed at establishing the relative importance of the various factors that contribute to causes of construction overruns and methods of minimizing those overruns. The steps used in analyzing the data: calculating the relative importance index; ranking of each factors based on relative importance index, and to determine degree of correlation on ranking the factors among the three groups.

RELATIVE IMPORTANCE INDEX

The contribution of each of the factors to overall delays was examined and the ranking of the attributes in terms of their criticality as perceived by the respondents was done by use of Relative Importance Index (RII) which was computed using Equation and the results of the analysis are presented in Tables 2 & 3. To determine the ranking of different factors from the viewpoint of owner, contractors and consultants, the Relative Importance Index (RII) was computed using RII Equation

$$RII = \sum W/ (A \times N)$$

Where
W = Weightage given to each factor by the respondents
A = Highest weight (i.e., 5 in this case)
N = the total number of respondents

QUESTIONNAIRE DESIGN & SURVEY

Questionnaire was developed to evaluate the perception of Owner, consultants, and contractors as to the relative importance of factors influencing the time and cost overlap in India. Dividing the questionnaire into two parts, the first part was general info about the respondent and the second part of the questionnaire focused on resource constraint factors, which caused the construction projects in India to overrun cost and time.

A descriptive survey method was adopted. With a list of the target respondents on hand, the distribution of the survey was directed to the potential respondents in person. The questionnaire survey was conducted with owners, consultants and contractors from various construction industries. The questionnaire was distributed to 170 construction professionals, out of which 155 responses were received and thus, the response rate of 91% was achieved.

The demographic characteristics of the respondents are given in Table: 1

Table: 1 Demographic characteristics of respondents

Demographic characteristic	Frequency	Percent
Gender		
Male	133	86.00
Female	22	14.00
Occupational level		
Engineer	72	46.50
Manager	64	41.30
Others	19	12.20
Working experience		
Less than 5 years	50	32.26
5-10 years	46	29.68
11- 15 years	39	25.16
More than 15 years	20	12.90
Types of stakeholders		
Owner	52	33.60
Consultant	36	23.20
Contractor	67	43.20
Annual turnover (Rupees)		
Less than 100crore	41	26.40
100-500 crore	43	27.60
501-1000 crore	43	28.00
More than 1000 crore	28	18.00
Educational background		
Diploma	50	32.40
B.E	92	59.70
M.E	13	7.90

Ranking of causes of Time overruns and Cost Overruns: Hierarchal assessment of factors was carried out to determine ranking of the factors based on level of significance. It was assessed based on Relative important index (RII) value and

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calculated for each group of respondent's i.e. owners, contractor and consultants and also the overall respondents as presented in Table: 2 & 3. It shows that top 5 most significant factors of time overruns ranked by overall respondents are Materials selection and change in types and specifications during constructions , Poor maintenance of equipment, Shortage of construction material, Financing between the owner and the contractor, Shortage of labour. Materials selection and change in types and specifications during constructions was ranked first (RII = 0.68) as agreed by the entire respondent.

Table 3 shows the top 5 most significant factors of cost overruns ranked by overall respondents are Inflation and escalation of material price, Change in project by owner, High transportation cost, frequent breakdown of the construction plant and equipment and rework due to errors during construction. Inflation and escalation of material price was ranked first (RII = 57.55) as agreed by all the respondents.

Table: 2 Important factors causing cost overrun

Factors of Cost overruns	Owner		Contractor		Consultant		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Inflation and Escalation of material price	55.53	1	53.6	1	62.6	1	57.55	1
Change in project by owner	49.09	4	52.8	2	52.13	7	53.14	2
High transportation cost	47.37	6	49.2	11	50.43	8	52.85	3
Frequent breakdown of the construction plant and equipment	50.09	4	50.4	8	56.52	2	51.85	4
Rework due to errors during construction.	51.8	2	49.6	9	53.91	3	50.28	5
Additional project management, consultancy and administrative cost.	40.1	18	43.2	16	43.47	17	49.42	6
Poor communication and coordination with other parties	41.80	17	48	12	53.04	5	47.71	7
Inappropriate construction method	47.37	6	51.2	6	50.33	9	47.32	8
Additional work at owners request	47.37	6	49.6	9	46.08	13	46.97	9
High maintenance cost of machinery	41.60	14	52.1	3	48.69	10	46.77	10
Shortage of materials	47.37	6	45.6	14	53.91	3	46.28	11
Ineffective planning & scheduling of project by contractor.	39.1	19	40	19	43.47	17	46.1	12
Unsafe practice at site	37.16	20	47.2	13	42.6	19	45.90	13
Lack of financial management and planning	44.75	11	41.6	18	52.17	6	45.17	14
Mistakes or discrepancies in documents or specification issued by consultant.	41.60	14	52	4	47.69	10	45.10	15
High quality of work required	50.4	3	43.2	16	44.34	16	45.10	15
Difficulties on importing equipment's and materials	44.75	11	39.8	20	45.21	15	44.90	17
High cost of machinery	42.42	13	44.8	15	46.95	12	44.28	18
Mistakes during construction	41.60	14	51.2	6	45.27	14	43.31	19
Wastage on site	47.37	6	52	4	42.5	20	43.26	20

Table: 3 Important factors causing time overrun

Factors of Time over run	Owner		Consultant		Contractor		Overall	
	RII	Rank	RII	Rank	RII	Rank	RII	Rank
Materials selection and change in types and specifications during constructions	0.78	4	0.66	12	0.66	1	0.68	1
Poor maintenance of equipment	0.68	11	0.65	14	0.66	1	0.66	2
Shortage of construction material	0.79	3	0.68	6	0.64	4	0.66	3
Financing between the owner and the contractor	0.77	5	0.67	10	0.64	4	0.65	4
Shortage of labour	0.84	1	0.62	17	0.63	6	0.65	5
Poor procurement of material	0.68	11	0.65	14	0.65	3	0.64	6
Lack of skilled labour	0.75	7	0.66	12	0.63	6	0.64	7
Availability of equipment	0.65	13	0.67	10	0.63	6	0.64	8
Poor quality of materials	0.75	7	0.63	16	0.63	6	0.64	9
Imported, Ordered materials and plant items	0.63	16	0.71	1	0.63	6	0.63	10
Cash Flow (Inflow & Outflow)	0.82	2	0.59	19	0.6	15	0.62	12
Slab of payment during construction	0.75	7	0.69	4	0.61	11	0.62	13
Financing by contractor during construction	0.77	5	0.69	4	0.61	11	0.62	14
Unqualified work force / Team	0.65	13	0.68	6	0.61	11	0.61	15
Slow delivery of materials	0.75	7	0.61	18	0.6	15	0.61	16
Unavailability of financial incentive	0.64	15	0.68	6	0.61	11	0.61	17
Disruption of accessories	0.61	18	0.68	6	0.57	18	0.6	18
Lack of motivation	0.61	17	0.7	2	0.58	17	0.59	19
Lack of communication	0.59	19	0.7	2	0.58	17	0.59	20

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6. CONCLUSION

It presents the important conclusions drawn from the analysis of perception regarding the identification and evaluation of factors affecting time and cost overruns in the construction projects. The top five factors for cost overrun in the index of importance ranging from 57.55 per cent-50.28 per cent are taken as the main factors from the statistical results. From the above results, it is concluded that the main factors are 'Inflation and escalation of material price', 'Change in project by owner', 'High transportation cost', 'frequent breakdown of the construction plant and equipment' and 'rework due to errors during construction'.

And The top five factors for time overrun in the index of importance ranging from 68 per cent-65 per cent are 'Material selection and changes in types and specifications during construction', 'Poor maintenance of equipment', 'Shortage of construction materials', 'Financing between the owner and the contractor' and 'Shortage of labour'. These factors should therefore be taken into account during planning and scheduling to minimize overrun construction time and cost. The model developed for finding the overrun can be implemented in any construction project. By knowing the expected deviation in advance, the planners can prepare the project schedule, accommodating the anticipated deviation. Making activity planning and scheduling a continuous process during construction, and also tracking the project with time and resources, will minimize overruns in time and cost. In order to avoid time and cost overruns, this implies there is a need for urgent attention to these variables.

7. RECOMMENDATIONS

Construction professionals may be given the following recommendations to minimize the delay in the construction project,

1. Construction participants can reduce and control the extent of the delays by taking care of the above-mentioned critical factors during project scheduling in present and future projects.
2. During the scheduling process appropriate weightage should be given to the resources to minimize the delay.
3. Manpower-related issues have the highest percentage contribution in the causes of delay and cost overrun; this can be overcome by allocating a sufficient number of skilled labour and motivating them to improve the productivity of labour.
4. Material related issues can be overcome by proper material procurement planning and avoiding selection of materials, and changing types and specifications during construction.
5. Equipment related issues may be minimized through proper equipment management and maintenance.
6. The time and cost overruns may be minimized by making the planning and scheduling of activities as a continuous process during construction and also by tracking the project with time and resources.
7. Finally, by strengthening the Project Implementation Unit (PIU) and the Project Management Unit (PMU), it is recommended that the overruns in construction projects be minimised.

This study provides good management intervention guidance and also some guidance and actionable information that managers can use to manage their projects.

8. REFRENCES

[1] Hatkar K B and Hedaoo N A 'Delay analysis by using relative importance index method in infrastructure projects' – Int. J. Civil Engg. Conc.Structs 2016 Vol. 1, No. 3, October 2016
[2] U.Sindhu Vaardini, S.Karthiyayini, P.Ezhilmathi 'Study on cost overruns in construction projects' –A REVIEW' International Journal of Applied Engineering Research, ISSN 0973-4562 Vol. 11 No.3 (2016)
[3] Serdar Durdyev, Syuhaida Ismail and Nooh Abu Bakar 'Factors causing cost overruns in construction of residential projects; case study of Turkey' international journal of science and management, (2012)
[4] Aishwarya Prashant Patil, 'Analysis of Cost over run in construction Projects' International Research Journal of Engineering and Technology Volume: 04 Issue: 11 | Nov -2017.
[5] Ismail Abdul Rahman, Aftab Hameed Memon and Ahrnad Tarmizi Abd. Karim 'Significant Factors Causing Cost Overruns in Large Construction Projects in Malaysia' Journal of Applied Sciences 13 (2): 286-293, 2013
[6] Ghaleb J. Sweis , Rateb Sweis , Malek Abu Rumman, Ruba Abu Hussein, Samer E. Dahiyat 'Cost Overruns in Public Construction Projects: The Case of Jordan' Journal of American Science (2013)
[7] Nabil Al-Hazim , Zaydoun Abu Salem 'Delay and cost overrun in road construction projects in Jordan' International Journal of Engineering & Technology, 4 (2) (2015) 288-293
[8] S. Shanmugapriya, Dr. K. Subramanian 'Investigation of Significant Factors Influencing Time and Cost Overruns in Indian Construction Projects' International Journal of Emerging Technology and Advanced Engineering , Volume 3, Issue 10, October 2013
[9] Mr. Salim S. Mulla, Prof. Ashish P. Waghmare 'A Study of Factors Caused for Time & Cost Overruns in Construction Project & their Remedial Measures' International Journal of Engineering Research and Applications Vol. 5, Issue 1, (Part -6) January 2015
[10] Anant Narayan Shete, Vaibhav Durwas Kothawade 'An Analysis of Cost Overruns and Time Overruns of Construction Projects in India' International Journal of Engineering Trends and Technology (IJETT) – Volume-41 Number-1 - November 2016
[11] Vaibhav Y. Katre, Dr. D.M. Ghaitidak "Elements of Cost and Schedule overrun in Construction Projects" International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 12, Issue 7 (July 2016), PP.64-68
[12] Aftab Hameed Memon , Ismail Abdul Rahman , Ade Asmi Abdul Azis "Preliminary Study on Causative Factors Leading to Construction Cost Overrun" International Journal of Sustainable Construction Engineering & Technology Vol 2, Issue 1, June 2011
[13] Sunil A. Kage, Meghendra R. Mane, Arjun M. Chougule, Abhishek V. Kadam, Rushikesh S. Majale " Time delay and cost overrun in construction industry of India" international journal of innovative research in science, engineering and technology