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Investigating Cost Overrun Factors in High-Rise Housing Projects in India

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***Abstract* - Cost overruns in building projects are typical in India. This might occur owing to a variety of factors. The aim of the study was to identify the factors impacting high-rise housing project costs in India, that are likely regulatable by head contractors. A questionnaire survey was used to perform this study with a group of related professionals from firms in the private as well as public sectors, having experience in high-rise housing projects. The frequency and impact of each factor were assessed based on the perspectives of the participants. The factors were then rated in order of the increasing Index of Relative Importance. The study identified significant factors that are likely to be regulated by head contractors, namely, productivity of labor, the performance of suppliers and sub-contractors, productivity of equipment, poor management of the site, scheduling, controlling and monitoring, inexperienced project managers, ineffective procurement planning of materials, ineffective procurement of equipment, delivery of materials (shortage or delay) and shortage of skilled labor.**
Keywords: **Cost Control, Cost Overrun Factors, Head Contractors, High-Rise Housing Projects**

I. INTRODUCTION

Cost overruns are regarded to be one of the most serious concerns that arise during the building project's execution [1]. Cost overruns will ultimately cause the project to fail [2]. Cost overruns are common in high-rise housing projects in India. It is becoming fairly common in most building projects. The Indian Construction Industry does not make use of different cost control software and techniques despite their initial development. Usually, cost overruns are experienced in building projects due to issues arising from poor cost control across design as well as the construction stages [4]. To survive, contractors must continuously improve the effectiveness of their cost control processes at both stages of construction by incorporating the most effective methods available [9]. Cost overruns are thus avoided, and contractors may avoid significant losses. Before forecasting and budgeting, it is also necessary to anticipate changes in labor, material, and equipment costs [3].

The literature reviewed indicates that several factors contribute to cost overruns. Among these factors, some are directly related to the contractors. Therefore, it is essential to investigate the factors that impact the cost performance of contractors in high-rise housing projects in India. As a result, this study conducted a thorough investigation to identify the factors impacting the cost of high-rise housing projects in India that are likely to be regulated by head contractors. Recent studies and research were used as a reference in finding out what affects the cost of the project. The study focuses only on high-rise housing projects and is based on a questionnaire survey which may have different results with different groups of participants. The sample size of the number of participants is also limited.

II. LITERATURE REVIEW

Most researchers in India have used questionnaire surveys to find cost overrun factors or these factors were identified by conducting interviews with related professionals. Table I summarizes 35 factors identified and categorized with reference details. Since these 35 factors were too large and had the same sense, they were cut down to fifteen factors related to head contractors and responsible for cost overruns.

Jadhav, Konnur, and Patil (2020) performed a study in Satara, India to find the main causes impacting construction project costs, with a particular emphasis on residential construction projects. A short questionnaire was used to find out the main causes impacting construction costs. The most significant factors were identified using the RII method and the ranking method. The factors identified in the study are contractual obligations, insufficient planning, excessive work problems, construction equipment procurement delays, poor management of the site, and cost fluctuations in building materials. These are the most critical factors [10].

Bhat (2019) conducted a study of Indian projects that dealt with analyzing time and cost overrun factors. A case study and a questionnaire survey were used to identify the factors and their impact on construction projects. These factors were ranked as significant and more significant factors. The factors identified in the study are paperwork - recording and maintenance of data, cash inflow and outflow, inadequate construction planning and decision-making, shortage of skilled labor, building regulation, and bureaucracy in Government agencies. All of these factors play a significant role [11].

TABLE I CATEGORIZATION OF FACTORS CONTRIBUTING TO COST OVERRUNS

Sl. No.	Factors Contributing to Cost Overruns	Citation	Code	Finalized Factors
1	Contractual obligations/disputes	[10], [12], [13]		
2	Insufficient planning and decision-making delays	[10], [11], [12], [13], [14]	F-01	Yes
3	Additional work at the owner's request	[10], [12]		
4	Local building regulation / Delay in approvals	[10], [11], [12]		
5	Poor management of the site	[10], [13], [15]	F-02	Yes
6	Performance of suppliers and sub-contractors	[10]	F-03	Yes
7	Construction equipment procurement delays	[10]		
8	Price fluctuations in construction material	[10], [12], [13], [14], [15]		
9	Lack of coordination	[11], [13]		
10	Paperwork – Recording and Maintenance of data	[11]		
11	Cash inflow and outflow	[11]		
12	Productivity of labor	[11]	F-04	Yes
13	Bureaucracy in government agencies	[11]		
14	Inexperienced project managers	[11]	F-05	Yes
15	Financial difficulties	[12]	F-06	Yes
16	Regular design changes	[12], [13]	F-07	Yes
17	Poor contractor selection	[12]	F-08	Yes
18	Inefficient procurement planning of materials	[12]	F-09	Yes
19	Repetitive work	[12], [13], [14]		
20	Delay in construction	[12]		
21	Regulatory framework and law changes	[12]		
22	Complexities in politics	[12]		
23	Unpredicted site conditions	[12], [15]		
24	Poor waste management	[13]		
25	Improper financial control at the site	[13], [15]		
26	Owner's high-quality expectations	[13]		
27	Kickbacks and fraudulent practices	[13]	F-10	Yes
28	Ineffective procurement of equipment	[13]	F-11	Yes
29	Higher shipping expenses	[14]		
30	Change in material specification	[14]		
31	Productivity of equipment	[14]	F-12	Yes
32	Scheduling, controlling, and monitoring	[15]	F-13	Yes
33	Improper management of resources in construction project	[15]		
34	Delivery of materials (shortage or delay)	[15]	F14	Yes
35	Shortage of skilled labor	[15]	F15	Yes

Devi and Ananthanarayanan (2017) conducted a study on Indian construction projects and identified causes impacting the cost performance of construction projects. A short questionnaire was floated among experts in this industry to collect data and analyze it using the RII method. The most significant factors identified in non-infrastructural Indian projects for construction cost overrun are financial difficulties, delay in regulatory approvals, scope expansion, changes in design, poor contractor selection, inefficient procurement planning, repetitive work, delay in construction, inefficient planning, decision-making delays, contractual obligations/disputes, regulatory framework, and law changes, complexities in politics, unpredicted site conditions, fluctuations in price [12].

Wanjari and Dobariya (2016) performed a study in India on construction projects to find the causes impacting construction costs. A short questionnaire was distributed to construction professionals to identify the most prominent factors responsible for impacting costs. These factors were

analyzed using ANOVA and SPSS. The top factors identified for cost overruns are raw materials price escalation, scheduled activity delays, miscommunication b/w construction parties, repetitive work, regular design changes, poor waste management, improper financial control at the site, bill settlement disagreement, ambiguity in the tender document, contract period reduction, owner's high-quality expectations, kickbacks and fraudulent practices, construction flaws, communication b/w site management and labors and force majeure [13].

Vaardini, Karthiyayini, and Ezhilmathi (2016) reviewed different literature on factors impacting construction project costs. A questionnaire was compiled and analyzed to find the main factors responsible for impacting cost in construction projects. The most significant factors identified based on reviews were unpredictable weather conditions, inefficient planning, and scheduling, rate fluctuations of materials, improper management at the site, poor controlling and monitoring, poor resources management, and improper financial control at the site [14].

Patil and Bhangale (2016) performed a study in India to find causes impacting construction costs in high-rise building construction. A questionnaire was developed and analyzed using the RII method to find the main causes. The most significant factors are higher shipping expenses, specification changes of materials, raw materials price escalation, breakdown of equipment, and repetitive work which impacts the cost of construction [15].

The research quoted in the study concludes that using a questionnaire survey is an appropriate tool for finding out the factors that result in cost overruns. The lacking matter is finding which factors are more likely to be regulated by head contractors in high-rise housing projects.

III. RESEARCH METHODOLOGY

This is an exploratory study to collect data on the factors impacting the cost of high-rise housing projects through a questionnaire survey. Research and studies on the construction cost challenges in India were investigated to establish a baseline starting point [4], [5]. Then, a questionnaire was prepared to explore current practices in high-rise housing projects in the Indian industry to identify the issues that contractors may be able to regulate. According to the Likert scale, participants are supposed to rank the frequency and severity of the causes on a scale of 1 to 5, with 1 being low and 5 being high.

Previous studies have used the Likert scale for equivalent objectives, such as [6], [7]. A quantitative analysis is carried out, which includes the relevant statistical tests. The results are sorted according to their likelihood and severity. The index of Relative Importance is used to prioritize the factors in order of their importance. This is one of the most commonly used strategies in such investigations [4], [8].

IV. FINALIZED FACTORS FOR QUESTIONNAIRE SURVEY

As shown in Table II, the 15 factors were drawn from the findings of various studies conducted throughout India on cost overruns. As a part of our preliminary study, interviews with experts helped in sorting out the factors impacting the cost performance of head contractors and what could lead to cost overruns in high-rise housing projects.

TABLE II FINALIZED FACTORS CONTRIBUTING TO COST OVERRUNS

Sl. No.	Finalized Factors for Questionnaire Survey	Code
1	Insufficient planning and decision-making delays	F-01
2	Poor management of the site	F-02
3	Performance of suppliers and sub-contractors	F-03
4	Productivity of labor	F-04
5	Inexperienced project managers	F-05
6	Financial difficulties	F-06
7	Regular design changes	F-07
8	Poor contractor selection	F-08
9	Ineffective procurement planning of materials	F-09
10	Kickbacks and fraudulent practices	F-10
11	Ineffective procurement of equipment	F-11
12	Productivity of equipment	F-12
13	Scheduling, controlling, and monitoring	F-13
14	Delivery of materials (shortage or delay)	F-14
15	Shortage of skilled labor	F-15

V. DATA COLLECTION

To serve the purpose of this study, a questionnaire was created and circulated to professionals from three government organizations as well as seven private companies with experience in high-rise housing projects. The outcome is shown in Table III.

TABLE III FINALIZED FACTORS CONTRIBUTING TO COST OVERRUNS

Organization Name	Sector of Work	Sent Forms	Received Forms	Participants %
NBCC (India) Limited	Public	20	17	85%
Hindustan Construction Company	Public	12	9	75%
Nagarjuna Construction Company Ltd.	Public	6	5	83%
Godrej Properties	Private	7	5	71%
Shapoorji Pallonji	Private	8	6	75%
Omaxe Group India	Private	4	3	75%
Tata High-rise housing projects	Private	10	7	70%
Hiranandani Group	Private	4	3	75%
Prestige Homes	Private	4	4	100%
Sobha Developers	Private	5	4	80%
	Total	80	63	78.9%

The questionnaire was divided into two sections. The 1st section was for an overview, and the 2nd part looked at cost overruns and how they affect the construction cost performance of head contractors based on their severity and likelihood. Table IV shows the outcomes of Section 1.

TABLE IV PARTICIPANTS' OVERVIEW

Qualification	40 Bachelors'		14 Masters'		9 PhD	
Experience	7 (<6 years)	8 (6-10 years)	10 (11-15 years)	17 (16-20 years)	12 (21-25 years)	9 (>25 years)
Current Jobs	18 at Head Office	19 Site Engineers	16 Project Managers	8 Planning Engineers	2 Architects	

Section 2 outcome showed the score of likely regulatable cost overrun factors by head contractors based on the participants' expertise. The score was given on a five-point (1-5) Likert scale, with both likelihood (frequency of occurrence) and impact (severity of consequences) considered. Table V depicts the scale's interpretation.

TABLE V SCALE'S INTERPRETATION FOR FREQUENCY AND SEVERITY

Scale Impact Likeli-hood	Ranking Score				
	1 No Never	2 Low Scarcely	3 Medium Occasionally	4 High Frequently	5 Extreme Always

VI. DATA ANALYSIS

Equation (1) is used to calculate each factor's Relative Importance Index (RII). It is calculated individually for severity (SRII) and frequency (FRII), and then a combined Relative Importance Index (CRII) is calculated using equation (2).

$$RII = \sum W \div (H \times N) \ldots (1)$$

$$CRII = SRII \times FRII \ldots\ldots (2)$$

where,

W: the total score given by the participant to each factor (ranges from 1 to 5)

H: highest rank (5)

N: total number of participants.

TABLE VI FINALIZED FACTORS CONTRIBUTING TO COST OVERRUNS

Factors	FRII	Rank	SRII	Rank	CRII	Rank
Insufficient planning and decision-making delays	0.58	9	0.63	7	0.366	15
Poor management of the site	0.61	6	0.69	3	0.420	4
Performance of suppliers and sub-contractors	0.64	3	0.69	3	0.442	2
Productivity of labor	0.65	2	0.73	1	0.472	1
Inexperienced project managers	0.60	7	0.59	8	0.412	6
Financial difficulties	0.58	9	0.67	4	0.385	12

VII. DISCUSSION

Based on CRII values, Table VI ranks the frequency and severity of all likely regulatable factors that affect the cost of high-rise housing projects in India. From the perspective of the head contractor, the top factors influencing the contractor's ability to control construction costs were identified. A subjective approach is used to identify the vital few factors based on their (CRII) values, the factors with the highest (CRII) values are considered to be the most likely regulatable cost factors. Table VII shows that ten factors as identified.

TABLE VII RANKING OF MOST LIKELY REGULATABLE FACTORS BY HEAD CONTRACTORS

Rank	Code	Factor	CRII
1	F04	Productivity of labor	0.472
2	F03	Performance of suppliers and sub-contractors	0.442
3	F12	Productivity of equipment	0.437
4	F02	Poor management of the site	0.420
5	F13	Scheduling, controlling, and monitoring	0.417
6	F05	Inexperienced project managers	0.412
7	F09	Ineffective procurement planning of materials	0.403
8	F11	Ineffective procurement of equipment	0.398
9	F14	Delivery of materials (shortage or delay)	0.397
10	F15	Shortage of skilled labor	0.391

VIII. CONCLUSION

Ten of the 15 most important factors in impacting construction cost were found to be closely related to head contractors. These variables were identified to be the most likely to be regulated by head contractors. The 10 most significant factors are productivity of labor, the performance of suppliers and sub-contractors, productivity of equipment, poor management of the site, scheduling, controlling, and monitoring, inexperienced project managers, ineffective procurement planning of materials, ineffective procurement of equipment, delivery of materials (shortage or delay) and shortage of skilled labor in high-rise housing projects, which are likely regulatable by head contractors.

REFERENCES

[1] S. L. Chan and M. Park, "Project cost estimation using principal component regression," *Construction Management and Economics,* Vol. 23, No. 3, pp. 295-304, 2005.

[2] D. Van Der Westhuizen and E. P. Fitzgerald, "Defining and measuring project success," *European Conference on IS Management, Leadership and Governance, Reading,* United Kingdom, 7-8 July 2005.

[3] Z. S. M. Khaled, Q. J. Frayyeh, and G. K. Aswed, "Forecasting the final cost of Iraqi public school projects using regression analysis," *Engineering and Technology Journal,* Vol. 33, No. 2, pp. 477-486, 2015.

[4] H. M. Morsy, "Cost control techniques and factors leading to cost overruns in construction projects," *Diploma Thesis,* Faculty of Engineering, Cairo University, Giza, Egypt, 2014.

[5] G. H. Ali, "Factors affecting the cost of building school buildings in Karbala," *Quarterly Refereed Journal for Natural and Engineering Science,* Vol. 3, A, No. 5 and 6, pp. 63-86, 2016.

[6] T. Ramachandra and J. O. B. Rotimi, "Causes of payment problems in the New Zealand construction industry," *Journal of Construction Economics and Building,* Vol. 15, No. 1, pp. 43-55, 2015.

[7] M. Gunduz, Y. Nielsen and M. Ozdemir, "Fuzzy assessment model to estimate the probability of delay in Turkish construction projects," *Journal of Management in Engineering,* Vol. 31, No. 4, pp. 1-14, 2011.

[8] Y. A. Olawale and M. Sun, "Cost and time control of construction projects: inhibiting factors and mitigating measures in practice," *Construction Management and Economics,* Vol. 28, No. 5, pp. 509-526, 2010.

[9] L. Ali, R. A. Ali, and Z. Khaled, "Investigation of Cost-Influencing Factors Potentially Controllable by Main Contractors in Construction Projects in Iraq," *Engineering and Technology Journal,* Vol. 38, Part A (2020), No. 07, pp. 1069-1076, 2020.

[10] D. Jadhav, B. A. Konnur and S. Patil, "Analysis of Factors Causing Cost Overruns in Residential Building Construction Projects," *International Journal of Research in Engineering, Science and Management,* Vol. 3, No. 7, July-2020, 2020.

[11] M. M. U. R. Bhat, "Factors Influencing Time and Cost Overruns in Indian Construction Projects," *International Research Journal of Engineering and Technology (IRJET),* Vol. 06, No. 03, Mar 2019.

[12] A. C. Devi and K. Ananthanarayanan, "Factors influencing cost over-run in Indian construction projects," *MATEC Web of Conferences,* Vol. 120, No. 02023, 2017.

[13] S. P. Wanjari and G. Dobariya, "Identifying factors causing cost overrun of the construction projects in India," *Sadhana,* Vol. 41, No. 6, pp. 679-693, June 2016.

[14] U. S. Vaardini, S. Karthiyayini and P. Ezhilmathi, "Study on Cost Overruns in Construction Projects - A Review," *International Journal of Applied Engineering Research,* Vol. 11 No. 3, 2016.

[15] Y. K. Patil and P. P. Bhangale, "Investigation of Factors Influencing Cost Overrun in High-Rise Building Constructions," *International Journal of Latest Trends in Engineering and Technology (IJLTET),* Vol. 6, No. 3, January 2016.