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Cost Escalation in Construction Projects

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Abstract: ***The Construction industry is an integral part of a country's economy, its growth and plays a pivotal role in developing the country's infrastructure. The current status report published by the Indian Ministry of Statistics and Programme Implementation (MOSPI) highlighted that out of the 951 projects being monitored 309 projects have cost overruns and 474 projects are behind schedule. The scope of this study is to investigate the importance levels of factors causes cost overrun in construction projects undertaken by construction companies. Eight factors named Design and Documentation Related Factors (DDF), Financial Management Related Factors (FIN), Communication Related Factors (ICT), Material and Machinery Related Factors (MMF), Human Resource Related Factors (LAB), Project Management Related Factors (PMCA), Contractors Site Management Related Factors (CSM), External Factors (EF) and their respective sub- factors are found to be responsible for cost escalation. Based on these above factors questionnaire was prepared and distributed 38 respondents. The data received from questionnaire survey was analyzed using Statistical Package of Social Science (SPSS) to carry out reliability test, hypothesis, correlation and ranking. The survey results indicated that Contractors Site Management Related Factors (RII=0.928), which is being most significant among the others that leads to delay in completion of the project and causes overrun.***

Keywords: ***cost overrun factors, Relative Important Index (RII), Statistical Package of Social Science (SPSS)***

I. INTRODUCTION

The Construction industry is one of the key economic industries in India and is the main motivating force in Indian national economy. Construction sector in India will remain buoyant due to increased demand from real estate and infrastructure projects. An investment of USD 1 Trillion has been projected for the infrastructure sector until 2017, 40% of which is to be funded by the private sector, 45% of infrastructure investment will be funnelled into construction activity and 20% set to modernise the construction industry. But, it suffers from a number of problems that affect time, cost and quality performances. Government data suggest that a majority of projects experience 60 per cent are overwhelmed by cost overruns. If present trends continue over the Eleventh and Twelfth Plan periods (2008 to 2017), McKinsey estimates suggest that India could suffer a GDP loss of US$ 200 billion around 10 per cent of its GDP in financial year 2017.

Investments Planned for Infra

	Tenth Plan (2002-07)	Eleventh Plan (2007-12)	Twelfth Plan (2012-2017)
Planned Investments	INR 8,70,000 cr	INR 20,50,000 cr	INR 41,00,000 cr
Actual Investments	INR 9,60,000 cr	INR 16,50,000 cr	-
Sectoral Mix	Power – 37%	Power – 32%	Power – 31%
	Roads – 14%	Roads – 14%	Roads – 12%
	Telecom – 11%	Telecom – 17%	Telecom – 25%
	Railways – 11%	Railways – 10%	Railways – 7%
	Irrigation – 13%	Irrigation – 12%	Irrigation – 9%
	More than targeted achievement in power	Added focus on telecom	Increased expenditure in ports, Oil & Gas platforms

Figure 1: Investment Planned for Infrastructure

A. Objective Of The Study

To identify the factors that causes cost overrun in various construction projects.
To prioritize the significant factor causing cost overrun among various other factors in construction projects.

II. LITERATURE REVIEW

Olawale, Y.A et al., (2014) [7] stated in their study that significant factors listed below causes delay in project due to time & cost overruns in Indian construction projects. Questionnaire for the survey was developed based on 76 factors of time overruns and 54 factors of cost overruns and grouped into 12 & 8 major groups. Adnan Enshassi et al., (2010) [2] found in his study that Construction projects located in the Gaza Strip, Palestine suffer from many problems and complex issues such as unavailability of competent staff, late delivery of materials and equipment, material shortage, waste rate of materials, escalation and fluctuation of material prices. Abdullah et al., (2009) [1] mentioned that 90% of large MARA construction project were suffered delay with significant effect of time and cost overrun that in 161 completed projects were found to be changes in scope and delays during construction. Seyed Ali Mousavi Dehmourdi (2014)[8] assessed the objective to apply the principles of engineering economics, basic economic concepts , finance and quantitative techniques to modelling and analysis of civil engineering projects to overcome cost overrun.

III. METHODOLOGY

The research methodology for present study has adopted questionnaire survey to identify the significant factors influences cost overrun in construction projects. From the literature review, the factors are identified and that was discussed with various construction company project managers, engineers, quantity surveyor and so on. Questionnaire was prepared based on 61 sub factors from 8 major groups of factors that influences cost overrun. Respondents from various construction firm were requested to rate the 4 point scale 1-4 ,for each factors which was to be considered the major reason for cost escalation in construction projects according to their experience and designation in the firm.

A. Factors Identification

Following factors were identified and categorized into their dependency through literature study

Table I

Main Factor	Sub Factor
Design And Documentation Related Factors (DDF)	Mistakes and discrepancies in design documents
	Delays in producing design documents
	Unclear and inadequate details in drawing
	Complexity of project design
	Insufficient data collection and survey before design
	Misunderstanding of owners requirements by design Engineer
Financial Management Factor(FIN)	Poor financial control on site
	Financial difficulties of owner
	Delay in progress payment by owners
	Delay payment to supplier / subcontractors
	Contractual claims such as extension of time with cost claims
	Difficulties in financial project by contractor
Information And Communication Related Factors (ICT)	Lack of coordination between parties
	Slow information flow between parties
	Lack of communication between parties

Main Factor and Sub Factor

Main Factor	Sub Factor
Material And Machinery Related Factors (MMF)	Fluctuation of prices of materials
	Shortage of materials
	Late delivery of material and Equipment
	Equipment availability and frequent breakdown
	Changes in material type and specification during construction
	Damages of sorted material while they are needed urgently
	Low productivity and efficiency of Equipment
	Low level of equipment operators skill
	Equipment shortage
	Poor quality of material
Human Resource Related Factors (LAB)	Labour productivity
	Shortage of site workers
	Labour Absenteeism
	High cost of labour
	Accident and injury during construction work at site
Contractors Site Management Related Factors (CSM)	Poor site management and supervision
	Incompetent subcontractors
	Schedule delay
	Inadequate planning and scheduling
	Lack of experience
	Mistakes during construction phase
	Inadequate monitoring and control of cost
External Factors (EF)	Effects of subsurface condition(eg: soil, nearer to water table)
	Delay in obtaining permits from municipality
	Rain effect on construction activities
	Unavailability of utilities in site (eg: water, electricity)
	Effect of social and cultural factors
	Traffic control and restriction at job site
	Changes in government regulation and laws
	Delay in providing services and utilities
	Natural disasters
	Land Acquisition

IV. DATA COLLECTION AND ANALYSIS

A. Respondent Profile

The questionnaires were distributed to the various construction industries. The respondents involved in the study had several years of experience in handling various different types of projects. The respondent's designation and experience along with type of projects handled are listed out in table II. Table II shows that 36% of respondents are project managers and followed by them project engineers, site engineers, quantity surveyor and planning and costing engineers. All the respondents had experienced in handling large projects with 54% of respondent executed high rise building projects. Among the respondents 28% had experienced in 100 projects

Table II
Respondents Profile

Parameter	Frequency	Percentage (%)

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Designation		
Project Manager	14	36
Project Engineer	4	24
Site Engineer	4	8
Quantity Surveyor	6	12
Planning and costing Engineer	10	20
Types of Project handled		
High rise building	12	54
Roads and Bridges	18	17
Industrial projects	6	13
Others	2	16
Year of Experience		
>50	22	34
50-75	8	22
75-100	2	16
>100	6	28

B. Reliability Analysis

The data collected from the questionnaire must be reliable and consistent so that the valuable information can be collected regarding the reason behind the cost escalation in construction industry. For such analysis, cronbach alpha for reliability is calculated using statistical tool SPSS version 21 as shown in table III. When the reliability of the data is less than 0.3, then the collected data will be not reliable and cannot be adopted. Reliability will be at high level only when the cronbach alpha is more than 0.6-0.9.

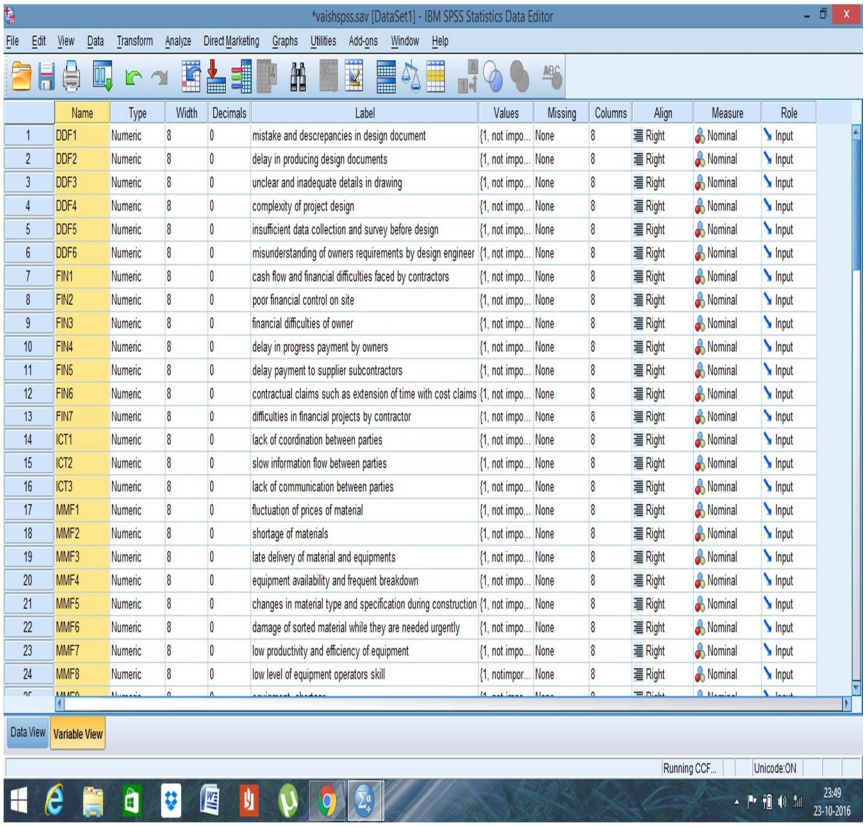

Figure 2: Factors and Sub Factors entered in SPSS Tool

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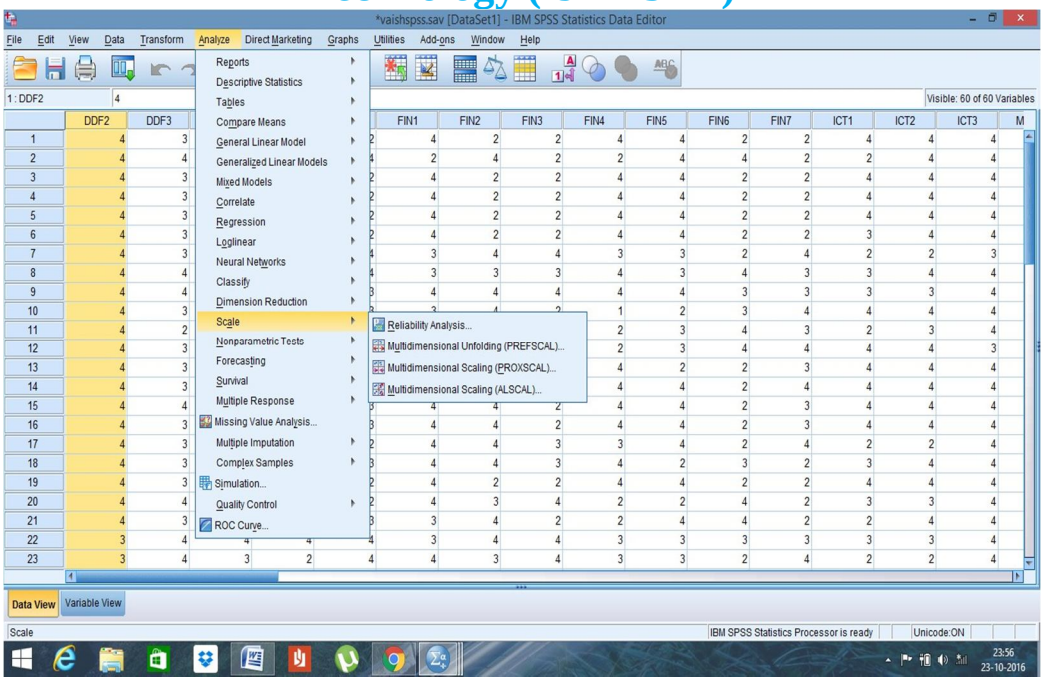

Figure 3: Reliability Analysis

Table IV
Reliability Test for Cost Overrun Factors

Factors	Cronbach alpha
Design and Documentation Related Factors(DDF)	0.693
Financial Management Related Factors(FIN)	0.612
Communication Related Factors (ICT)	0.623
Material And Machinery Related Factors (MMF)	0.643
Human Resource Related Factor(LAB)	0.677
Project Management Related Factors(PMCA)	0.683
Contractors Site Management Related Factors (CSM)	0.726
External Factors (EF)	0.658
Overall cronbach alpha value	0.664

C. Relative Important Index (RII)

Relative Important index (RII) have been employed and calculated for ranking of causes of cost overrun in the construction project. The RII is used to rank the different causes. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the groups of respondents. Each individual cause's RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction cost overrun in construction industry.

$$RII = \frac{\sum W}{A \times N}$$

W = Weighting given to each factor by the respondents and ranges from 1 to 4
A = Highest weight (i.e. 4 in this case)
N = Total number of respondents

Table V
Ranking Criteria

Very important for cost overrun	Important for cost overrun	Somewhat important for cost overrun	Not important for cost overrun
N4	N3	N2	N1
4	3	2	1

Table VI
Ranking of Cost Overrun Factors

Factors	RII	Rank
Design and Documentation Related Factors(DDF)	0.813	2
Financial Management Related Factors(FIN)	0.658	7
Communication Related Factors (ICT)	0.686	6
Material And Machinery Related Factors (MMF)	0.708	5
Human Resource Related Factor(LAB)	0.718	4
Project Management Related Factors(PMCA)	0.789	3
Contractors Site Management Related Factors (CSM)	0.928	1
External Factors (EF)	0.627	8

V. CONCLUSION

Factors responsible for the cost escalation in construction projects have been identified from Relative Important Index (RII), Hypothesis and Frequency level were determined and subsequently ranked accordingly and as well the overall cronbach value is 0.664 which means, the collected data was reliable. The Contractor's Site Management Related Factor (CSM) has higher ranking among other factors and contains highest reliable value, which means that the collected data was reliable and that is the significant factor responsible for cost escalation which leads to delay in completion of the project and major reason for cost overrun. Cost overrun problems occur as a result of ineffective construction management and other poorly designed control systems that contribute to delays and complete the project on planned schedule time and cost. A simple and effective monitoring system is essential to identify effective strategic planning, proper project planning and scheduling, proper emphasis on past experience, effective site management, frequent progress meeting, frequent coordination between the parties, use of experience subcontractors and suppliers, use of appropriate construction method and quality based aspect in completion of project reduces the rework problem and enhances the project as per schedule.

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