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Causes and Effects of Delays in Indian Construction Projects

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Abstract - *In India, several construction projects experiencing more delays which results in exceeding the initially fixed delivery time and cost. "Delay can be defined as the time overrun or the extension of time to complete the project". This paper aims to find out the most significant factors causing delays in Indian construction projects through literature review and questionnaire survey. From the literature review 103 causes of delays categorized into 8 different groups, 8 effects of delays were found and also rankings given by each authors for the delaying factors are not the same due to varying native and context. Further, the Questionnaire survey is conducted with the participants (contractors, owners, consultants and others) of Indian construction industry in order to shortlist the top 20 significant factors with respect to Indian context and finally recommendations are given to avoid delays in construction project.*

Key Words: *Construction Management, Causes of Delays, Effects of Delays, Construction Industry, India.*

1. INTRODUCTION

This Construction industry is the second largest and basic input for socio-economic development of our country after agriculture, which has contributed an estimated amount of ₹ 928418 crore to the national GDP in 2014-15, a share of around **8.04**% (Planning Commission, Government of India). Though construction projects in India facing various problems, delay in construction is one of the major issues. It is defined as "the time overrun, either beyond the completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project". It is considered as a common problem in construction projects. In most of the projects, there will be delays and their impact level varies on each project which depends on several factors such as nature and the type of construction, importance of the project, etc.

When the project gets delayed, either the delivery time of the project will be extended or the progress of the project will be accelerated heavily in order to deliver it on time. The former will lead to arbitration, litigation, and penalties, etc. and the later will lead to incur additional cost, both will end up with loss of money. In worst case, accelerating the process of the project will also affect the quality of the output which sacrifices client's satisfaction.

The construction process could be divided into three phases, i.e. conception of the project, designing of the project and finally construction of the project. Chan and Kumaraswamy (1997) stated the vast majority of project delays occur during the construction-phase, where many unforeseen factors are always involved. According to Al-Khalil and Al-Ghafly (1999) "delays can adversely impact on project stakeholders, such as owner, contractors, etc. It means loss of revenue for the owner due to lack of production facility and loss of profit for the contractor due to higher overhead costs". However, a delay in a construction project can be caused either by owner or by the contractor or by numerous other reasons. In some case, number of delays could be caused simultaneously either by owner or contractor without any dependence with each other, these are said to be 'concurrent delays' which is the most critical topic to deal with, and always leads to arbitration process.

Completing the project on specified time saves lots of money which is an indication of efficiency and an effective project management, however, it is a rare case of happening. Azhar and Farouqui (2008) observed that "Delays on construction projects are a universal phenomenon in which the trend of time and cost overrun is common worldwide and it is more severe in developing countries".

2. LITERATURE REVIEW

Ahsan and Gunawan (2010) made a separate study comparing the performance of international development projects in India, China, Bangladesh, and Thailand, in which they reported that construction projects in India showed the worst schedule performance. The study found that in India average schedule overrun is the highest (55% of actual schedule) compared to the other nations. Shebob.A, Dawood.N and Xu.Q (2011) made a Comparative study b/w Libya and UK construction project through questionnaire survey. The delay factors were ranked using the frequency of occurrence and severity scale. The survey result exposed that the construction projects in the developing countries suffers more delay than the developed countries due to lack of technology in the developing countries. Towhid Pourrostam and Amiruddin Ismail (2012) related the field of causes of delay in construction projects has been reviewed over the last decade through a questionnaire survey conducted in Iranian to solicit the causes of delay from consultants and contractors' viewpoint.

Ibrahim Mahamid (2013) conducted a survey on time performance of different types of construction projects in Saudi Arabia to determine the causes of delay and their importance according to each of the project participants, i.e, the owner, consultant and the contractor. Then finally he concluded that 76% of the contractors and 56% of the consultants indicated that average of time overrun is between 10% and 30% of the original duration and also found 70% of the projects experienced time overrun in Saudi (i.e. 53 out of 76 projects).

J.Raj Bharath & Prof Siddesh K Pai (2013) have mentioned that recently commissioned, Bandra-worli sea link amply demonstrates the state of project delivery system in the country. It was planned as Rs300 crore project to be completed by 2004, but had actually cost of Rs1600 crores with the delay of five years. Ruth apolot, henry alinaitwe & dan tindiwensi (2013) made a case study and concluded that the stakeholders in the construction industry are advised to minimize the change in scope of work as it has the most effect on cost and time overrun and recommended there should be change from the traditional contract type to the design-build type and improved cash flow on the part of the client so as to reduce payment delays.

Ghulam Abbas Niazai and Kassim Gidado (2013) reported that contract with less than 12 months highly contributes to delays. They concluded that two causes of delay are common between all parties, which are 'security' and 'corruption'. Poor security is the most difficult challenges that stakeholders face in implementing construction projects. It has delayed projects and increased costs. Corruption constitutes a serious threat to Afghanistan Construction Industry improvement as it has significant effects on construction delays. There is an urgent need for developing a legal framework for fighting corruption, whereas the current framework has been outdated and unclear.

Anu V. Thomas and J. Sudhakumar (2014) mentioned that low productivity leads to delays in construction and reported the results of questionnaire survey made to identify the factors influencing construction labour productivity with the project managers, site engineers, supervisors and craftsmen, in the state of Kerala, India, and also mentioned timely availability of materials at the worksite, delayed material delivery by the supplier, strikes called by political parties or hartals, frequent revisions of drawings/design, resulting in additional work/rework and timely availability of drawings at the worksite as a significant impact on labour productivity. Nitin Chaphalkar and K. C. Iyer (2014) said, in some cases disputes may raise b/w the stakeholders during the construction phase, in which if it's not handled properly, tend to consume time and money of the parties disputing, which leads the project to extended stay.

Prakash Rao and Joseph Camron Culas (2014) had concluded that, ineffective planning & scheduling of project, delays in site mobilization and delay in sub-contractor's work are three most critical factors caused by the contractor, affecting the project performance, followed by client's contributing factors such as delay to furnish & deliver the site, late in revising & approving design documents. Owolabi James et.al (2014) used random sampling technique to list out the most significant causes of delays in construction project. From the survey they observed that 51% of the delays are caused by the client, followed by the contractor with 36% and the consultant with 13%. ARC document solutions (2015) study shows that the problems with document management is a major source of delays and time overrun on construction projects.

3. CAUSES AND EFFECTS OF DELAYS

From the literature review, 103 causes of delays categorized into 8 different groups were found in order to make a questionnaire survey with the respective participants (contractors, owners, consultants and others) of Indian construction industry and also 8 effects of delays were observed. The number of causes and effects are given below.

3.1 Causes of Delay

Group-A Owner Contributed Factors

1. Delay in progress payments
2. Delay to furnish and deliver the site
3. Change orders (plan/design) & extra orders by owner during construction
4. Late in revising and approving design documents
5. Delay in approving shop drawings and sample materials
6. Slowness in decision-making process
7. Conflicts between joint-ownership of the project
8. Suspension of work by owner
9. Owners lack of experience and involvement
10. Bureaucracy in client's organisation
11. Unavailability of professional construction management (i.e. consultant)

Group-B Contractor Contributed Factors

12. Difficulties in financing project/insolvency
13. Conflicts in sub-contractor's schedule during execution
14. Rework due to errors during construction
15. Conflicts between contractor and other participants
16. Ineffective & inadequate early planning and scheduling of project
17. Implementing improper & obsolete construction methods
18. Fraudulent practices and kickbacks
19. Negotiations and obtaining of contracts
20. Inadequate contractor's work & experience & also poor risk management and ignorance

21. Delays in sub-contractors work and their incompetent which leads to frequent change in sub-contractors
22. Poor supervision & managerial skills and lack of training personnel
23. Use of many sub-contractors leads to lack of control over sub-contractor
24. Poor estimation of project time and quantities of material required before contracting
25. Often changing project schedule
26. Unsafe working condition due to improper safety management by the contractor

Group-C Consultant Contributed Factors

27. Poor qualification & Inadequate experience of consultant's engineering staff
28. Delay in approving overall designs, shop drawing, sample tested materials and major changes in the work
29. Incompetent/Poor management by consultant
30. Delaying in performing site inspection & testing
31. Consultant's reluctance for change and their inflexibilities

Group-D Designer contributed factors

32. Insufficient data collection and survey before design
33. Mistakes and discrepancies made in design documents leads to frequent revisions of drawings/designs
34. Inadequate design team experience & delay in producing design documents
35. Unclear and inadequate details in drawings and also slow response on doubts arising from the drawings
36. Using poor/old engineering design software
37. Financial problems
38. Complexity of project conception & designing
39. Misunderstanding of owner's requirements by design engineer

Group-E Labour Contributed Factors

40. Shortage of labours
41. Working permit of labours
42. Low skilled/productivity level or unqualified labours
43. Personal conflicts among labours
44. High labour wages insists to hire low amount of labours
45. Labour exodus/evacuated from the region
46. Labour strikes at site
47. Labour Safety & health problems when working in hazardous conditions and their absenteeism
48. Slow mobilization & demobilization of labour
49. Nationality and language of labours
50. Lack of motivation

Group-F Material Contributed Factors

51. Shortage of construction materials in market
52. Changes in material types during construction
53. Delay in material delivery especially while importing
54. Damage of sorted material while they are needed urgently due to improper storage of materials
55. Delay in manufacturing special-building materials
56. Late procurement of materials/late ordering
57. Quality problem with procured material
58. Procuring undesired or unwanted material instead
59. Problem with material transport and processing at site (lack of adequate space for storing materials in site)
60. Price fluctuation/inflation in material prices
61. Late in selection of finishing materials due to availability of many types in market
62. Sudden increase in quantity needed

Group-G Equipment Contributed Factors

63. Equipment breakdown and their idle time and lack of tool in market
64. Shortage of heavy equipment when needed
65. Low level of equipment-operator's skill
66. Low productivity and efficiency of equipment
67. Wrong kind or verity of equipment/selection
68. Lack of hi-tech, advanced and special equipment
69. Complication of hiring and transporting to the site
70. Limited mechanization due to cheap labour cost in the locality

Group-H External Factors

71. Effects of unforeseen subsurface and changing ground condition (e.g. Soil, high water table) factors
72. Delay in obtaining permits from municipality
73. Weather, climate (hot or cold) & rain effects on construction activities
74. Heavy traffic, over-crowd & other restrictions at site
75. Accident during construction
76. Changes in government regulations and laws
77. Unavailability/poor temporary facility of utilities in site (such as water, electricity, telephone, etc)
78. Civil unrest/public strikes
79. Economic crisis
80. Delay in performing final inspection and certification by a third party
81. Bureaucracy restriction by government agencies
82. Slow site clearance due to restrictions
83. Work complexity

84. Inadequate overall organizational structure
85. Litigation b/w various parties in the mid of construction
86. Poor government judicial system for construction dispute settlement
87. Security (checking process for quality and other purposes)
88. Corruption & hostile political conditions and also strikes called by political parties or hartal
89. Effects of social and cultural factors
90. Original contract duration is too short – Unrealistic time schedule imposed in contract
91. Lack of motivation for contractors for early finish and ineffective delay penalties
92. Types of construction contract (Turnkey or design/construction only)
93. Type of project bidding and award (negotiation, lowest bidder.)
94. Aggressive competition at tender stage
95. Short bid preparation time leads to improper bidding by contractor
96. Land acquisition
97. Faulty soil investigation report
98. Delay in finalisation of rates for extra items
99. Lack of periodic meeting among the management, site personnel and the contractors and also weekly project evaluation meetings
100. Problem with neighbours
101. Improper project document management
102. Lack of database and experience for estimating activity duration and resources required in a new type of construction project
103. Poor communication and coordination b/w the participants of the construction project (owners, contractors & sub-contractors, designers, consultants, workers and suppliers) observed. The number of causes and effects are given below

3.2 Effects of Delay

1. Time overrun
2. Much reduction in profit for the contractor due to cost overrun
3. Non-productivity loss for the owner due to extended stay of construction phase
4. Distrust with contractor and damage for the company's reputation
5. Distrust insists the owner to delay the progress payment which leads to contractor's cash-flow problem
6. Dispute, Arbitration or Litigation b/w the participants of the project
7. Abandonment of project
8. Difficult in improving the market value of the contractor's company

4. METHODOLOGY

Initially literature review was made in order to find out the delay causing factors in construction project which assisted in making a questionnaire survey with the professional experts and other participants of Indian construction industry in order to find out the relative importance of those found causes with respect to Indian context.

4.1 Questionnaire Survey

By assuming random sampling technique, a total number of 100 questionnaires were sent to many professional experts in various parts of the country through mail but got only 36 responses from the survey and further 4 questionnaires were taken directly with the reputed companies in the locality in order to round the respondents to 40 from the overall survey. Though the sample size is relatively small, the quality of the responses was considered to be highly reliable for the analysis due to relevant industry experiences and clear understanding of the questionnaires among the respondents (Vaus, 2001).

Relative Importance Index method is adopted to determine the relative importance of the various causes of delays. In this case, four-point Likert scale were adopted which ranges from 1 (not important) to 4 (extremely important) and transformed to relative importance index (RII) for each factors using the formula shown below:

Relative Importance Index, **RII** = $\frac{\sum W}{A*N}$

Relative importance index ranges b/w 0 to 1 i.e. ($0 \leq RII \leq 1$), higher value indicates more importance for that cause of delay. where W = weighting given to each factor by the respondents which ranges from 1 to 4 where '1' is 'not important' and '4' is 'extremely important', A = highest weight (i.e. 4 in this case), and N = total number of respondents (i.e. 40 in this case).

Table-1 shows the sample format of undertook Questionnaire survey. Each cause's RII is been assessed by combining the opinion of overall respondents (contractors, consultants, owners and others) which is assumed as a general opinion among the experts of Indian construction industry.

Table-2 shows the top 20 delay-causing factors considered as relative importance by the respondents, which is been listed out in the ascending order of rank with respect to RII perceived. Rank 1 indicates the most important factor causing delay and followed by other factors.

Table -1: Sample Format of Questionnaire Survey

CATEGORY	FACTORS CAUSING DELAY	RELATIVE IMPORTANCE			
		NOT IMP	SOME IMP	IMP	EXT. IMP
OWNER	1. Delay in progress payments				
	.				
	.				
CONTRACTOR	12. Difficulties in financing project/insolvency				
	.				
	.				
CONSULTANT	27. Poor qualification & Inadequate experience of consultant's engineering staff				
	.				
	.				
DESIGNER	32. Insufficient data collection and survey before design				
	.				
	.				
LABOUR	40. Shortage of labours				
	.				
	.				
MATERIALS	51. Shortage of construction materials in market				
	.				
	.				
EQUIPMENT	63. Equipment breakdown and their idle time and lack of tool in market				
	.				
	.				
EXTERNAL FACTORS	71. Effects of unforeseen subsurface and changing ground condition (e.g. Soil, high water table) factors				
	.				
	.				
	103. Poor communication and coordination b/w the participants of the construction project (owners, contractors & sub-contractors, designers, consultants, workers and suppliers)				

Table -2: Top 20 Delay-Causing Factors

CATEGORY	FACTORS CAUSING DELAY	$\sum W$	RII	RANK
CONTRACTOR	Inadequate contractor's work & experience & also poor risk management and ignorance	139	0.86875	1
EXTERNAL	Poor communication and coordination b/w the participants of the construction project (owners, contractors & sub-contractors, designers, consultants, workers and suppliers)	139	0.86875	2
MATERIAL	Delay in material delivery especially while importing	138	0.8625	3
CONTRACTOR	Ineffective & inadequate early planning and scheduling of project	136	0.85	4
CONTRACTOR	Poor supervision & managerial skills and lack of training personnel	135	0.84375	5
LABOUR	Low skilled/productivity level or unqualified labours	135	0.84375	6
OWNER	Delay in progress payments	134	0.8375	7
CONTRACTOR	Delays in sub-contractors work and their incompetent which leads to frequent change in sub-contractors	132	0.825	8
OWNER	Change orders (plan/design) & extra orders by owner during construction	132	0.825	9
OWNER	Owners lack of experience and involvement	131	0.81875	10
EXTERNAL	Accident during construction	129	0.80625	11
DESIGNER	Unclear and inadequate details in drawings and also slow response on doubts arising from the drawings	128	0.8	12
CONSULTANT	Delay in approving overall designs, shop drawing, sample tested materials and major changes in the work	127	0.79375	13
EXTERNAL	Effects of unforeseen subsurface and changing ground condition (e.g. Soil, high water table) factors	123	0.76875	14
CONSULTANT	Delaying in performing site inspection & testing	123	0.76875	15
DESIGNER	Mistakes and discrepancies made in design documents leads to frequent revisions of drawings/designs	122	0.7625	16
EXTERNAL	Improper project document management	122	0.7625	17
LABOUR	Shortage of labours	120	0.75	18
MATERIAL	Shortage of construction materials in market	118	0.7375	19
EQUIPMENT	Equipment breakdown and their idle time and lack of tool in market	117	0.73125	20

5. CONCLUSION WITH RECOMMENDATIONS

From the above list of most significant factors causing delay in the construction, *Inadequate contractor's work & experience & their poor risk management and ignorance* ranks first with the RII 0.86875. By recognising this fact, awarding the project to the competent contractor who has lot of experience in the specific project type will avoid this kind of delay in the project, in which specialised and global contractors know well to tackle the pressurised situation by adopting effective risk management skills. Though *communication and coordination between the participants* as the same RII 0.86875 as of contractor's work experience, it is considered as the second most significant factor causing delay in the project with respect to the priority compared. It plays vital role in the effective progress of the construction. The company which is not up to date with the information communication technology will be lagging in the progress and can't survive in the competitive market. Latest information communication technology will boost up the productivity of the communication which reduces the chances of getting delayed.

The major reason behind all these causes is lack of commitment and coordination within the project participants. The commitment of the project participants drastically affects the quality and the progress of the project. Issue of delay in construction is common globally, but its causes & effects varies with respect to native, context and culture of the construction industry. Contractors should effectively plan and schedule the project in advance by considering all possible risk factors with respect to the nature and culture of the locality. Commitment from top to bottom level management is more important in which periodic review and correction should be made in all aspects (safety, quality, material, equipment) to avoid unnecessary delays and cost overruns. Unskilled workers are inefficient, in which labours and supervisors should be well trained with effective training program to improve their knowledge. Delivery of construction materials should be dealt carefully with the vendors which affects the progress of the project utmost. Owner should be well aware about the effect of changing orders during construction and delay in progress payment, which affects the project completion on predefined time.

REFERENCES

[1] Shebob, A, Dawood, N and Xu, Q (2011) "Analysing construction delay factors in building construction" *Association of Researchers in Construction Management*, 1005-1012

[2] Chidambaram Ramanathan, SP Narayanan and Arazi B Idrus (2012) "Construction Delays Causing Risks on Time and Cost – a Critical Review" *Australasian Journal of Construction Economics and Building*, 12 (1) 37-57

[3] Towhid Pourrostam and Amiruddin Ismail (2012) "Causes and effects of delay in Iranian construction project" *International Journal of Engineering and Technology*, Vol. 4, No. 5

[4] Hemanta Doloi, Anil Sawhney, K.C. Iyer, Sameer Rentala (2012) "Analysing factors affecting delays in Indian construction projects" *International Journal of Project Management*, 479–489

[5] J.Raj Bharath & Prof Siddesh K Pai (2013) "Analysis Of Critical Causes Of Delays In Indian Infrastructure Projects" *International journal of innovative research & development, vol2 issue3*, 251-263

[6] Ruth apolot, henry alinaitwe, dan tindiwensi (2013) "An Investigation into the Causes of Delay and Cost Overrun in Uganda's Public Sector Construction Projects" *Second International Conference on Advances in Engineering and Technology*, 305-311

[7] Ghulam Abbas Niazai and Kassim Gidado (2013) "Causes of Project Delay in the Construction Industry in Afghanistan" *Journal of Construction Engineering & Management*

[8] Anu V. Thomas and J. Sudhakumar (2014) "Factors Influencing Construction Labour Productivity: An Indian Case Study" *Journal of Construction in Developing Countries*, 19(1), 53–68

[9] Prakash Rao and Joseph Camron Culas (2014) "Causes of delay in construction projects" *International Journal of Current Research Vol. 6, Issue, 06*, pp.7219-7222

[10] P.M.Pethkari and B.V.Birajdar (2014) "Literature review on causes of delay in building construction projects" *Journal of Information, Knowledge and Research in Civil Engineering, Volume 3, Issue 2*, 217-220

[11] Owolabi James D, Amusan Lekan M, Oloke C.O, Olusanya O, Tunji-Olayeni P, OwolabiDele, PeterJoy (2014) "Causes and effects of delay on project construction delivery time" *International Journal of Education and Research Vol. 2 No. 4*, 197- 208

[12] Aditi Dinakar (2014) "Delay analysis in construction project" International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 5, 784-788