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DELAY ANALYSIS IN CONSTRUCTION PROJECTS

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Abstract- Construction business is huge and is experiencing vital delays. Delays in construction comes can't be one hundred percent avoided or eliminated. Delay occurs virtually in each construction project and therefore the cause liable for the delays varies from project to project. Delay are often outlined as the time overrun or the extension of time to complete the project on a timely basis. Delays will be minimized, once the foundation causes are identified. The aim of this study is to find root causes responsible for delay. The analysis is administrated on literature review and questionnaire survey. On learning varied works on delays, forty six reliable causes were chosen to arrange a questionnaire. The questionnaire form was distributed for response, the response was analyzed by RII and 80/20 rule. The analysis shows some cause with high RII worth (highly severe cause) as: strikes, external or internal military actions, Unforeseen conditions/natural calamities, Mistakes in soil investigation, Slow permits by government agencies, Unfavorable site conditions.

Keywords: Delay1, Causes2, Effects3, Types4 etc

1. INTRODUCTION

Construction industry is the second vital economic sector after agriculture that plays crucial role in social and economic development of India. Construction of economic and different non commercial structures have increased the living standards of individuals living in rural and urban India .The construction industry in India has contributed an quantity of 9cr in value in financial year 2014-2015[planning commission of India].

1.1 Description of delays

Beside the achievements construction projects are facing multiple issues, delay in construction is a major issue .Delay can be defined as difference in time between project completion as stated in the contract and the date of actual completion of project .A contract document suggests the starting date and date of completion of the project .If by any means, problem occur during construction, the completion time is extended beyond the agreed time period and delay arises. Over a long period of time, construction industry in Kashmir division is experiencing major delays in construction projects this results in economic backwardness of the valley .The disturbance of law and order is the main cause for the delay of projects which in turn results in the economic backwardness. The various projects which got delayed due to negligence of formal governments in kashmir , flood of 2014 and turmoil of 2016 are: Jahangir chowk to Rambagh flyover, Rawalpora Bagimehtab bridge on Doodh ganga river, Shalteng Bridge over Jehlum (193 meters), Kishan Ganga hydropower project.[Greater Kashmir, January 2018]

1.2 Objectives

The main objectives of this analysis are:

1. Determine the causes that are to blame for delay.

2. Determine the results caused by delay.

3. To review the utilization of advanced tools and techniques in managing delays.

2. LITERATURE REVIEW

Diana Binti Musa in June 2012 has worked on “causes and effects of delay in construction industry projects”. According to her research projects can be delayed due to number of reasons that may due to client, contractor, acts of God or third party. According to the study delays can be minimized when causes are identified. The study was carried out on literature review and questionnaire survey. The serious causes which contributed to the delay includes insufficient number of equipments , poor site management and supervision, shortage of materials, improper project planning and scheduling, incompetent project team, contractors financial difficulties.

Ankush C. Khona, Ashish Jayshinpure on July 2018 published paper “reduction of delays in infrastructure projects ”.In this paper they explained the proper way to reduce the delays to greater extent. They give following steps: Perform advocate initial planning, Script out a well defined WBS, Proper vendor evaluation selection, Regular tracking and monitoring, Clear and continuous communication .Thus executing the project in above

mentioned manner will help to reduce the delays in projects.

Shruti and S.dinish published paper "a review on causes of delay in construction projects" on may 2014. According to this study delays can minimized only when there causes are identified .The causes of delay where categorized into different groups to make a questionnaire survey on account of owner, contactor, labor, equipment, material respectively .The paper also reports about the effects of delay as: Time overrun, Profit reduction for contractors, Distrust within the parties, Delay in the work progress payments, Disputes between the owner and contractor. The study tells about the following two techniques for analyzing the impacts of delay:

a. Relative importance index technique.

b. Importance index technique.

Sadi A, Sadiq in 2006 published paper on "causes of delay in large construction". In this paper following main causes of delay where identified by field survey: change order by owner during construction to avoid delay, delay in progress payment, ineffective planning and scheduling, labor shortage. All the three parties were involved contractor, owner and client.

Prakash Rao and Joseph Camron published paper "causes of delays in construction projects a case study". In this study causes, effects and methods of minimizing delays are identified by literature review and survey reports.

Ali and Mohammad Al Mohsin in December 2013 has published journal on "Causes of delay in completion of construction projects in Oman". Field survey was conducted on number of construction projects in Muscat to identify causes which lead to delay in completing the projects on time .The study says collected data was divided into two groups, the first group included projects constructed during (2007-2008) and second group included projects constructed (2009-2010). In both the groups, it was found that 40% of delay was experienced in completing the projects on time. It was also found that owner related causes were found to be most effective reasons for delay.

Leena Mali, Abhijit Warundkar have published paper "Analysis on causes of delay in construction industry in pune city". In international journal of innovative research in science, engineering and technology, issue 8, august 2016. Leena and Abhijit identified causes, effects and methods of minimizing delays. 83 questionnaires were distributed at 23 construction sites and the response was collected from different stakeholders. The factors responsible for delay were divided in 9 groups: project, client, consultant, contractor, designer, equipment, external and material. This study has been carried out on literature review and a questionnaire survey. In this study 10 causes were found which have great impact on delay: frequent change of subcontractors, poor qualification of contractor's technical staff, delay in site mobilization, late in reviewing and approving design document by consultants, damage of sorted material while its sorted, late procurement of materials, lack of high technology mechanical equipments, shortage of labor, delay in providing services for utilities, market inflation.

Md Aftab uddin, Dr. Syed Khursheed Ahmad and Mohd Danish published paper, "types and causes in construction delay" in international research journal of engineering and technology, volume 4, issue 7 July 2017. This study mainly focuses on delay of construction in building projects. The different parties such as clients, consultants, planners, designers, contractors, suppliers and subcontractors involved in the construction projects and the causes of delay were categorized accordingly. The result states delay occur mainly due to: shortage of labor, shortage of construction material, extra work like rework and change order.

Tsegay Gebrehiwet, Hanbinluo published paper on "Analysis of delay impacts on construction projects based on RII and correction coefficient, Empirical study" in science direct, creative construction conference19 to 22 june 2017. In this study, a questionnaire with 52 causes and 5 effects of delay were collected from 77 respondents. The influential causes of delay were: corruption, unavailability of utilities at site, inflation, lack of quality material, late design and documents, slow delivery of materials, poor site management and performance, late release of funds. The critical effects of the delay analysis were cost overrun, time overrun and termination of contract.

3. CONSTRUCTION DELAYS

Delay may be a amount of time by which something is late or delayed .In construction business delay is outlined as time distinction between actual completion of project and project completion time as expressed in contract document. Delay is one in all the foremost common issues in construction projects resulting in disputes and claims. Delays are totally loss situations: all the concerned parties' loss one or alternative way. Delay analysis is an investigation carried on account to find what causes the project to run late and who is accountable for the delays. [Assaf and Hejji] has defined delay as Time overrun either beyond completion date laid out in a contract, or date on

which concerned parties agreed upon for delivery of a project slithering over its planned schedule. Delays are chiefly of following types: Excusable and non excusable delays, Critical and non critical delays, Concurrent delays.

3.1 Excusable and non excusable delays:

Excusable delay is that delay caused by the unforeseen events beyond the control of construction parties. Excusable delay is more classified into two types: a. Excusable non compensable delay: these delays are caused by variety of factors that aren't in control of owner, contractor or the other party. In this sort of delay contractor is allowed to increase the construction time period. Such delays embody act of God. b. Excusable compensable delay: These delays are caused by owner or his representatives. Owner offers a decent time and monetary damage to contractor to complete the project.

3.2 Non excusable delays:

These are caused because of contractor's or subcontractor's fault and negligence. The contractor is susceptible to pay compensation to the owner as per the contract agreement.

3.3 Critical and non critical delays:

These delays rely upon critical path of the project. If a delay happens in the activities of critical path, it have an effect on the project completion time. In some projects there is also more than one critical paths and it results in the disputes over the occurred delays. but non critical delays doesn't affect the project completion time however it's to be kept in mind delay is around critical path and may affect completion time if it consumes out offered float

3.4 Concurrent delays:

Concurrent delays are those delays that are caused by completely different parties at the same time which may have an effect on project completion time. this kind of delay is the most difficult sort of delay as each parties can use this delay against each other. Owner will use this delay to gather liquidated damages whereas contractors will use it to waive their inexcusable delays. [Alkass S. et al] says that once there are excusable delays, contractor is entitled to time extension just in case date of completion is extended. Such delays can additionally affect non vital activities which should be thought of with more detailed analysis or adjustment of float time.

3.5 Effects of delay:

In the study on "impact of construction delays in the industry of construction" [sambasivan, 2007] the following six impacts were pointed: total abandonment, Arbitration, time overrun, Cost overrun, dispute and Litigation. Also [Ahmed et al. 2000] stated that impact of delays in construction project could cause; provocative relationship, cash flow problem, disbelief, project rejection, general sense of trepidation among parties and lawsuit. In the case, the result pointed by alternative researchers and therefore the connected studies universally, the subsequent effects were determined to be the most effect of delay: Adversarial relationship, Time overrun, Cost overrun, Distrust, Cash flow problems, Arbitration and litigation.

4. METHODOLOGY

In order to attain the objectives, literature review was created to choose the causes that are to blame for delay with the assistance of specialists who were associated with construction field. A form was setup containing total 46 causes. Thirty copies of questionnaire were sent to the various reputed construction corporations and firms. Out of 30, only twenty three responses were received. All the 23 respondents have sent different response which was considered reliable as a result of the clear understanding of questionnaires. The questionnaire was organized within the variety of severity level. Ordinal scale was used to rank the questions starting from zero to three [Enhassi et at 2009]. The table below indicates the illustration of each number of ordinal scale respectively.

Scale	Indication
0	No severity
1	Low severity
2	Moderate severity
3	High severity

4.1 Relative importance index:

The analysis was carried out by RII method. Relative importance index of each cause is given:

$RII = \Sigma W / (H*N)$

$= (3n1+2n2+1n1+0n0+\ldots\ldots) / (H*N)$

Where W= weightage given to each cause by respondents, N= total number of respondents (23 in this case), H= highest weightage (3 in this case), n3= response for high severity, n2= response for moderate severity, n1= response for low severity, n0= response for no severity.

5. RESULTS

The information was collected from totally different construction organizations including contractors, engineers, consultants, supervisors, draftsmen, workers. This analysis supported literature review and questionnaire survey investigates causes and effects of delay. Applying RII to every cause, severity was obtained. The causes were ranked on the premise of RII value. Higher the RII value higher, greater is that the rank. The study shows five vital causes accountable for delay based on RII value are: Strikes, external or internal military actions, Unforeseen conditions/natural calamities. Mistakes in soil investigation, Slow permits by government agencies, Unfavorable site conditions. The table below shows the ranking and RII worth of every cause.

Table 1: causes of delay, raking and rii value

S.No	Name of cause	RII	Rank	Cumulative index	Cumulative Percentage
1	Strikes, external or internal military actions	0.91	1	0.91	3.47
2	Unforeseen conditions/natural calamities	0.83	2	1.74	6.64
3	Mistakes in soil investigation	0.75	3	2.49	9.50
4	Slow permits by government agencies	0.74	4	3.23	12.32
5	Unfavorable site conditions	0.71	5	3.94	15.03
6	Poor site safety	0.69	6	4.63	17.66
7	Delay in obtaining permits from municipality	0.69	6	5.32	20.29
8	Poor economic conditions (currency, inflation rates etc)	0.68	7	6.00	22.88
9	Poor supervision of work at site	0.64	8	6.64	25.32
10	Unethical behavior used by the contractors to achieve the highest possible level of profit	0.64	8	7.28	27.77
11	Lack of sub contractor's skills	0.62	9	7.90	30.13
12	Poor site management	0.62	9	8.52	32.49
13	Major disputes and negotiations	0.62	9	9.14	34.86
14	Poor judgment in estimating time and resources	0.61	10	9.75	37.19
15	Cash problems during constructions	0.61	10	10.36	39.51
16	Lack of technical and managerial skills of staff	0.59	11	10.95	41.76
17	Price escalation of materials and man power	0.59	11	11.54	44.01
18	Fraudulent practice and setbacks	0.58	12	12.12	46.22
19	Unskilled machine and tool operators	0.58	12	12.70	48.44
20	Contract modification (replacement and addition of new work to the project and change in specification	0.58	12	13.28	50.65
21	Shortage of construction materials at site	0.56	13	13.84	52.78
22	Lack of personal training and management support	0.56	13	14.40	54.92
23	Difficulties in financing projects by contractors	0.56	13	14.96	57.06

24	Lack of communication among contractor, engineer and site workers	0.56	13	15.52	59.19
25	Traffic control and restrictions at job site	0.56	13	16.08	61.33
26	Low productivity and efficiency of equipments	0.55	14	16.63	63.42
27	Work complexity	0.55	14	17.18	65.52
28	Insufficient contractor competition	0.55	14	17.73	67.62
29	Low speed of decision making with each party	0.54	15	18.27	69.68
30	Conflicts between contractors and other parties	0.54	15	18.81	71.74
31	Rework due to errors during construction	0.53	16	19.34	73.76
32	Suspension by the owner or contractor	0.53	16	19.87	75.78
33	Technical problems faced by contractor	0.52	17	20.39	77.77
34	Mistakes during construction	0.51	18	20.90	79.71
35	inaccurate organizational structure	0.49	19	21.39	81.58
36	Owner's interference	0.49	19	21.88	83.45
37	Lack of materials in markets	0.49	19	22.37	85.32
38	Delay in material delivery	0.48	20	22.85	87.15
39	Dependency on newly graduated engineer to bear the whole responsibility of site	0.46	21	23.31	88.90
40	Facing problems while transporting goods	0.46	21	23.77	90.66
41	Lack of ample space for materials	0.45	22	24.22	92.37
42	Abrupt change in design	0.43	23	24.65	94.01
43	Poor material handling at site	0.43	23	25.08	95.65
44	Incomplete drawings	0.4	24	25.48	97.18
45	Living arrangement of workers near site	0.39	25	25.87	98.67
46	Accident during construction	0.35	26	26.22	100.00

6. CONCLUSIONS

The aim of the study was to acknowledge the cause that has adverse impact on the performance of construction projects. A comprehensive literature review was carried out to choose the causes liable for delay. From the comprehensive study of connected articles forty six causes of delay were selected. The study shows five causes out of 46 are have the highest Severity. These 5 causes are:

a. Strikes, external or internal military actions.

b. Unforeseen condition/natural calamities.

c. Mistakes in soil investigation.

d. Slow permits by government agencies.

e. Unfavorable web site conditions.

Delays can't be eliminated fully however will be decreased to larger extent by taking care at construction stage. Additionally delays will be decreased once the root causes are encountered.

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BIOGRAPHIES

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