

Analysis of Delay in Construction Projects in India

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Abstract - *The construction industry is large, volatile, and requires tremendous capital outlays. Delays occur almost in every construction project and the significant of these delays varies considerably from project to project. In construction, delay could be defined as over run of a time either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rentable space or a dependence on present facilities.*

Keywords: *Building construction projects, Delays, Relative importance index.*

INTRODUCTION

Delays are one of the biggest problems facing by the construction industry. The delays in construction projects have significant financial and social impact to all parties involved in the projects. Construction delay is a major problem facing by the construction industry. In most construction projects, there are delays and their impact level varies from project to project ranging from a few days to years. It is generally understood that the construction delay is the most critical factors affecting to deliver the project in time, within budget, and expected quality. It can be found rarely that a project was completed within the specified time. There are various negative effects of delays such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination. Effects of delays which predominantly affects are loss of Interest by the Stakeholder, blacklist by Authorities, waste of Money and Time, Declination of Reputation etc. Delays caused by contractors can generally be attributed to poor managerial skills. Lack of planning and a poor understanding of accounting and financial principles have led to many a contractor's downfall. In this study, most critical factors causing delay and their effects in large building construction projects in India.

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rentable space or

a dependence on present facilities.

OBJECTIVES OF STUDY

The main objectives of this study include the following.

1. To identify the source of delays for construction projects.
2. To study cost of delay and methods to mitigate delays.
3. To study the effect of delays for construction projects.
4. Analysis of data collected of live projects regarding delays of activity.
5. Give the discussion and suggestion for minimum of effects of delays for construction projects.
6. To suggest the methodology to work out the importance by different techniques

METHODOLOGY

- Literature Collection
- Review of Literature
- Factors Identification
- Data Collection

ANALYSIS OF DATA

Causes of Delay

Cause of delays in construction projects are mainly as:

- 1) Project related delay
- 2) Owner related delays
- 3) Contractors related delays
- 4) Consultant related delays
- 5) Design related delay
- 6) Material related delays
- 7) Equipment related delays
- 8) Labour related delays
- 9) External factors related delays

Effect of Delay

Following are the effect of delay in construction projects

1. Overtime
2. Overcost
3. Disputes
4. Total abandonment
5. Litigation
6. Arbitration
7. Litigation
8. Arbitration
9. Data Analysis

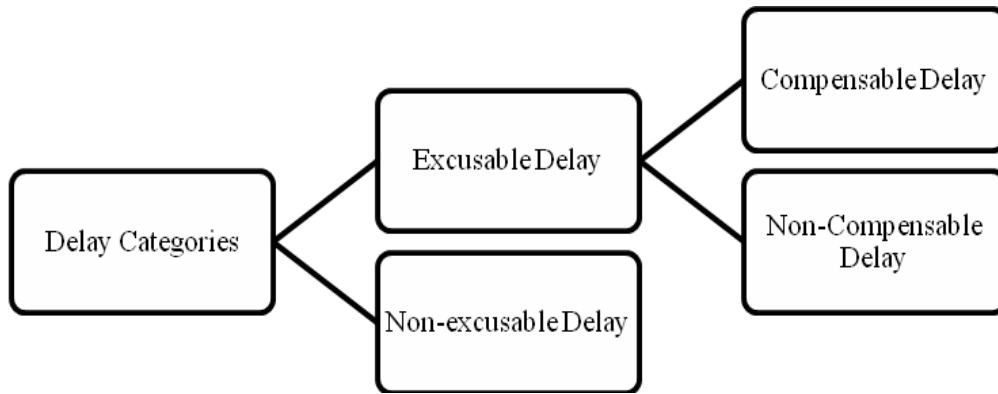


Figure 1-Types of delays

The data analysis will be done by relative importance index technique Relative Importance Index technique: S.M.Renuga and Balasubramanian Malathi used the Relative Importance Index method to determine the relative importance of the various cause of delays. The same method is going to be adopted in this study. The five-point scale ranged from 1(not much) to 5 (very important) will be adopted and will be transformed to relative importance indices (RII) for each factors as follows:

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

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 4 (0 not inclusive), higher the value of the RII, more important was

the causes of delays. The RII was used to rank the different uncertainty factors that cause delay. These ranking made it possible to cross-compare the relative importance of the uncertainty factors as perceived by the respondents.

Questionnaire Survey

Questionnaire were completed at the meeting with the project manager, planning engineer this method had the added benefit of making clarification to respondent about the uncertainty factors and gives chances to surveyor to explore possible uncertainty factors influencing the construction projects. Totally 22 surveys were completed and the consolidated results of these uncertainty factors in means of importance scale are carried out by relative importance index method (RII).

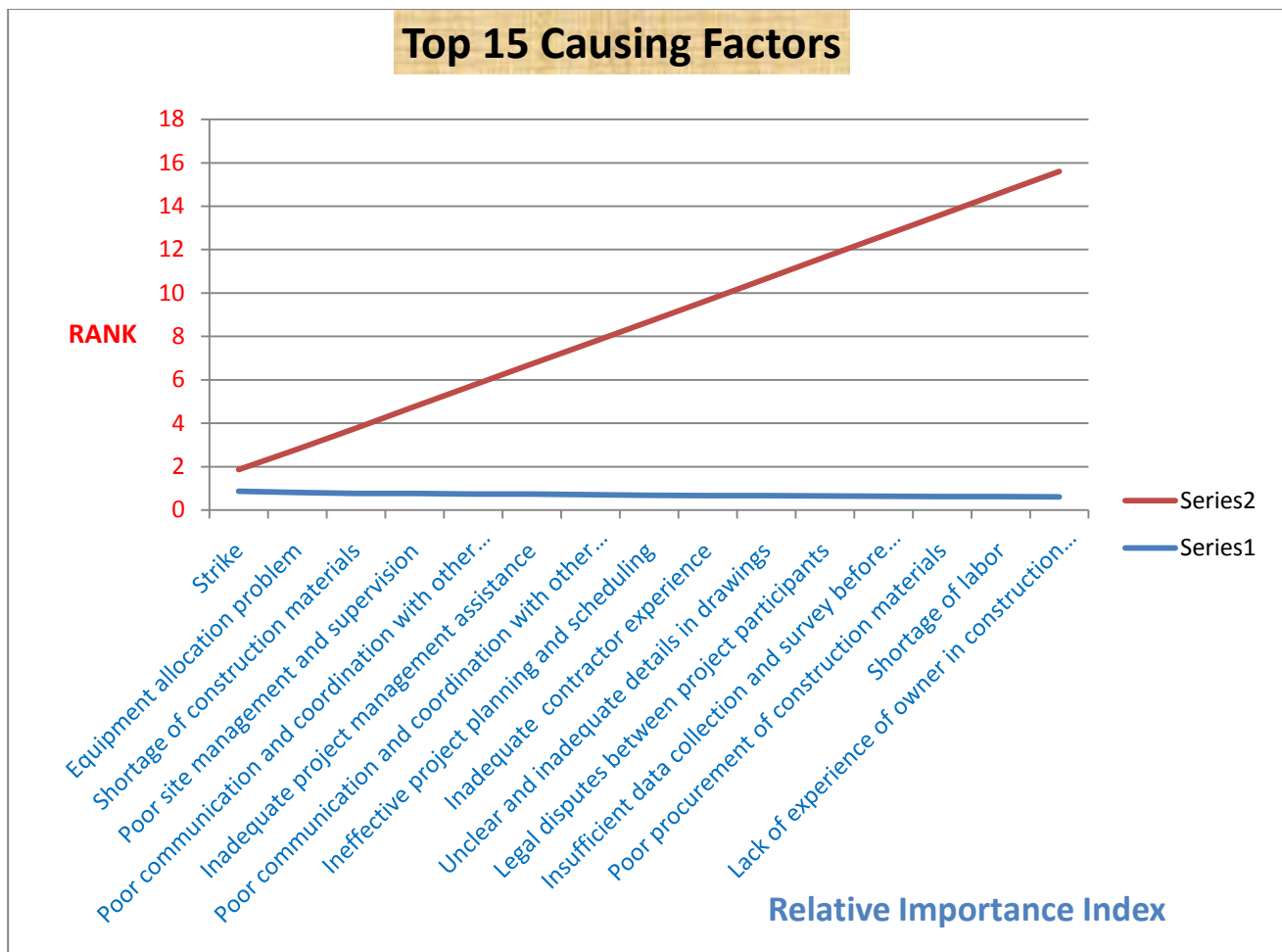
Table 1 Survey Results According to RII

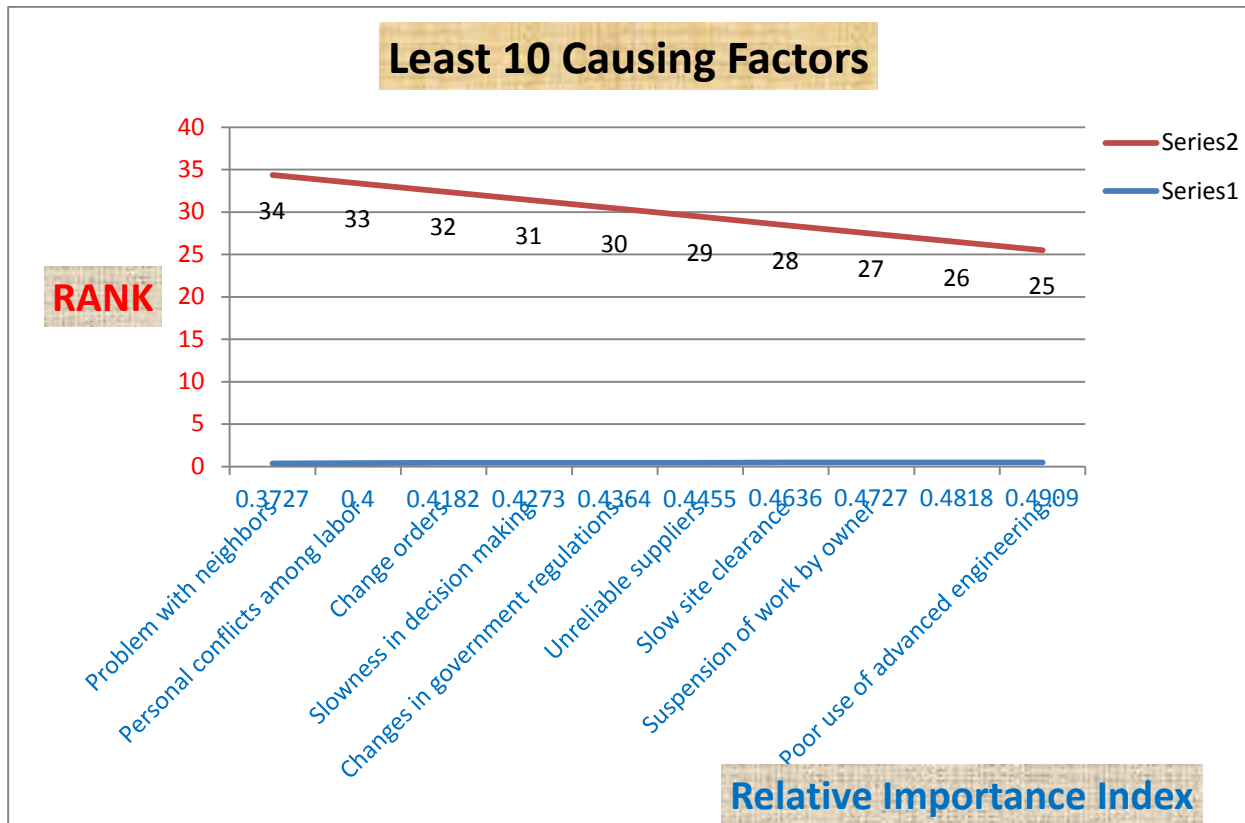
S.No	Factors causing schedule delays	QUESTIONNAIRE																						SUM	RII	RANKING
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22			
	Consultant Related Factors																									
1	Lack of experience of consultant in construction projects	4	4	5	4	4	5	4	5	4	4	4	2	3	5	5	3	2	3	3	2	5	4	84	0.76364	4
2	Conflicts between consultant and design engineer	3	4	4	3	4	4	4	4	3	3	4	2	2	4	3	3	2	2	4	4	4	3	73	0.66364	10
3	Delay in approving major changes in the scope of work by	3	3	3	4	3	3	3	3	4	3	3	3	3	4	4	2	5	2	3	3	3	5	72	0.65455	11

27	Unclear and inadequate details in drawings	2	4	4	2	4	4	4	4	2	3	4	5	4	4	5	2	3	3	3	5	4	3		78	0.7 090 9	7
	Equipment Related Factors																										
28	Equipment allocation problem	5	4	4	4	4	3	4	4	4	2	4	4	4	4	5	5	4	4	3	5	5	4		89	0.8 090 9	2
29	Frequent equipment breakdowns	3	3	3	2	3	3	3	3	2	2	3	4	4	3	3	4	4	4	4	4	3	2		69	0.6 272 7	13
30	Improper equipment	2	2	2	2	2	2	2	2	2	3	2	3	3	3	2	4	2	2	3	3	1	2		51	0.4 636 4	28
31	Inadequate modern equipment	2	2	3	2	2	2	2	3	2	3	2	2	2	0	2	2	3	3	2	2	1	1		45	0.4 090 9	41
32	Low efficiency of equipment	3	3	4	3	4	3	2	4	3	3	3	3	3	3	3	5	3	2	4	2	1		67	0.6 090 9	15	
33	Shortage of equipment	3	3	4	3	4	3	2	4	3	3	3	3	2	3	3	3	2	2	2	2	3	3		63	0.5 727 3	18
34	Slow mobilization of equipment	3	4	4	4	3	4	3	4	4	2	4	5	2	4	4	2	3	3	3	3	3	3		74	0.6 727 3	9
	External Related Factors																										
35	Accidents during construction	2	3	3	3	3	3	3	3	3	4	3	2	3	3	3	3	3	2	3	3	2	3		63	0.5 727 3	18
36	Changes in government regulations and laws	1	3	3	2	3	2	1	3	2	4	3	3	3	2	2	2	2	1	1	1	2		48	0.4 363 6	30	
37	Conflict, war, and public enemy	2	3	3	1	3	3	2	3	1	2	3	3	3	2	2	2	3	2	3	3	2	1		52	0.4 727 3	27
38	Delay in obtaining permits from municipality	3	1	3	2	3	1	3	3	2	3	3	1	3	2	1	3	3	3	2	3	3		54	0.4 909 1	25	
39	Delay in performing final inspection and certification by a third party	2	3	4	4	4	3	2	4	4	3	3	1	1	3	3	3	4	2	0	2	3	4		62	0.5 636 4	19
40	Delay in providing services from utilities (such as water, electricity)	3	3	4	3	4	3	3	4	3	2	3	3	3	3	2	3	3	2	3	3	3	3		66	0.6	15
41	Global financial crisis	2	2	3	1	3	1	1	3	1	2	2	3	5	2	1	1	4	1	1	2	2	4		47	0.4 272 7	31
42	Loss of time by traffic control and restriction at job site	2	2	2	3	2	1	3	2	3	2	2	2	5	2	2	3	3	3	3	2	2	1		52	0.4 727 3	27
43	Natural disasters (flood, hurricane, earthquake)	2	3	3	4	3	3	3	3	4	2	3	5	3	2	3	2	3	3	3	3	3	2		65	0.5 909 1	16
44	Price fluctuations	1	2	2	1	2	3	2	2	1	3	2	3	4	3	1	2	4	2	2	2	1	1		46	0.4 181 8	32
45	Problem with neighbors	1	2	3	2	3	2	1	3	2	2	2	1	2	2	1	1	4	1	1	3	1	1		41	0.3 727 3	34
46	Slow site clearance	2	2	3	3	3	2	2	3	3	2	2	1	2	2	2	1	3	3	2	3	3	2		51	0.4 636 4	28
47	Unexpected surface & subsurface conditions (such as soil, hw table)	2	1	2	2	2	1	4	2	2	3	1	3	3	3	1	3	3	3	4	5	2	1		53	0.4 818 2	26
48	Unfavorable weather conditions	3	2	2	4	2	2	4	0	4	3	2	2	3	2	2	3	4	3	4	5	3	4		63	0.5 727 3	18
	Labor Related Factors																										
49	Absenteeism	3	3	3	3	3	4	3	3	3	3	3	3	3	2	5	4	3	3	3	3	3	3		69	0.6	13

																								272 7		
50	Low motivation and morale of labor	2	3	4	3	3	3	2	4	3	3	3	2	3	3	2	2	2	2	2	2	2	1	56	0.5 090 9	24
51	Low productivity of labor	3	4	4	4	4	4	3	4	4	3	4	2	3	4	3	3	2	2	2	3	3	4	72	0.6 545 5	11
52	Personal conflicts among labor	1	2	2	2	3	2	2	2	2	2	2	3	2	3	2	2	2	2	2	2	1	1	44	0.4	33
53	Shortage of labor	4	3	2	4	2	4	4	2	4	3	3	2	2	4	5	2	4	4	4	4	4	4	74	0.6 727 3	9
54	Slow mobilization of labor	3	3	3	5	2	4	3	3	5	2	3	3	3	4	4	3	3	3	3	3	3	1	69	0.6 272 7	13
55	Strike	5	4	4	5	4	1	5	4	5	4	4	4	4	5	5	5	5	5	5	5	4	4	96	0.8 727 3	1
56	Unqualified / inadequate experienced labor	2	3	3	4	3	3	3	3	4	3	3	4	3	2	4	4	3	3	3	3	2	2	67	0.6 090 9	15
	Material Related Factors																									
57	Changes in material types and specifications during construction	2	2	2	3	2	3	2	2	3	2	2	4	4	2	2	2	3	3	3	3	2	2	55	0.5	24
58	Damage of sorted materials	2	3	3	3	3	4	2	3	3	3	3	3	3	1	2	3	2	2	2	2	2	1	55	0.5	24
59	Delay in manufacturing materials	3	3	3	3	2	1	3	3	3	3	3	4	2	4	4	3	2	2	2	4	3	3	63	0.5 727 3	18
60	Escalation of material prices	1	2	2	2	2	3	2	2	2	2	2	3	2	3	3	4	1	2	2	2	2	2	48	0.4 363 6	30
61	Late delivery of materials	3	2	2	4	2	3	3	2	4	3	2	3	3	4	4	3	3	3	3	3	4	2	65	0.5 909 1	16
62	Poor procurement of construction materials	3	1	1	3	1	4	3	1	3	4	1	4	4	3	3	4	2	2	2	2	2	2	55	0.5	24
63	Poor quality of construction materials	2	3	3	2	3	3	2	1	2	4	3	2	3	4	2	4	2	2	2	2	1	1	53	0.4 818 2	26
64	Shortage of construction materials	3	1	1	4	3	1	4	1	4	3	1	3	3	4	4	3	4	4	4	4	3	4	66	0.6	15
65	Unreliable suppliers	2	1	1	3	1	1	2	3	3	3	1	2	2	4	1	3	4	2	2	4	2	2	49	0.4 454 5	29
	Owner Related Factors																									
66	Change orders	1	2	3	2	3	1	2	3	2	2	2	2	3	1	2	2	2	2	2	2	2	1	44	0.4	32
67	Conflicts between joint-ownership	2	2	3	3	3	2	2	4	3	3	2	2	3	2	2	2	2	2	3	3	2	3	55	0.5	24
68	Delay in approving design documents	3	4	4	3	3	3	3	4	3	3	4	2	2	3	4	4	2	3	3	2	3	3	68	0.6 181 8	14
69	Delay in progress payments	4	3	3	4	4	3	4	3	4	3	3	3	2	4	3	4	2	4	3	2	4	4	73	0.6 636 4	10
70	Delay in site delivery	4	3	3	3	3	4	4	4	3	2	3	1	4	3	3	3	3	3	4	4	3	2	69	0.6 272 7	13
71	Improper project feasibility study	3	4	4	2	3	4	3	4	2	3	4	4	3	3	4	3	3	3	3	4	2	3	71	0.6 454 5	12
72	Lack of capable representative	2	3	3	2	3	3	2	3	2	3	3	2	1	3	3	3	3	2	2	1	2	2	53	0.4 818 2	26
73	Lack of experience of owner in construction projects	4	4	3	3	1	3	4	3	3	3	4	2	2	1	3	1	2	4	4	2	4	4	62	0.5 636 4	19

74	Lack of incentives for contractor to finish ahead of schedule	2	3	4	2	2	2	2	4	2	2	3	2	2	2	4	2	2	3	2	2	2	1		52	0.4 727 3	27
75	Poor communication and coordination with other parties	3	2	2	4	3	3	3	2	4	3	2	3	3	3	3	3	3	3	3	1	3	3		62	0.5 636 4	19
76	Slowness in decision making	3	2	2	2	1	2	3	2	2	2	2	1	3	1	2	2	2	2	2	4	2	3		47	0.4 272 7	31
77	Suspension of work by owner	3	3	3	2	2	2	2	3	2	2	3	2	1	2	3	2	2	2	2	4	3	2		52	0.4 727 3	27
	Project Related Factors																										
78	Complexity of the project	2	3	2	4	2	3	3	2	4	4	3	3	1	2	2	3	1	3	3	3	2	4		59	0.5 363 6	22
79	Inadequate definition of substantial completion	3	3	2	3	2	3	2	2	3	3	3	2	2	3	2	3	4	2	2	1	3	3		56	0.5 090 9	24
80	Ineffective delay penalties	4	2	3	2	2	2	4	3	2	3	2	4	3	2	3	2	1	4	3	2	4	4		61	0.5 545 5	20
81	Legal disputes between project participants	3	4	4	3	4	3	2	4	1	4	4	4	1	4	4	4	4	2	4	3	3	3		72	0.6 545 5	11
82	Original contract duration is short	4	4	2	2	4	3	4	2	2	3	4	2	4	4	3	4	4	4	4	3	3	2		71	0.6 454 5	12
83	Unfavorable contract clauses	2	2	4	2	1	2	2	3	2	3	2	2	3	2	4	2	1	2	2	2	2	2		49	0.4 454 5	29





RESULT AND DISCUSSION

The RII method was used to achieve this objective and it can reveal the most influential factors within each category of causes. There are eighty three factors that contributed to the causes of delays were identified and ranked from the viewpoint of engineers, contractor and overall. Delays are inevitable; however, they can be avoided or minimized when their causes are effectively identified and analyzed. The aim of this study was to assess the effect of delays on building construction projects in India. A total of 83 delay attributes were identified and categorized into nine groups of consultant related delay factors, contractor related delay factors, design related delay factors, equipment related delay factors, external related delay factors, labor related delay factors, material related delay factors, owner related delay factors, and project related delay factors. The computed RIIs provided a benchmark for ranking all the attributes and group of delays so as to inform the basis for determining the most significant and insignificant factors in the Indian context.

1. A labor related factor of schedule delay was the most importance group to cause schedule delays. This was mainly due to factors “Strike (RII = 0.8727)”, “Poor procurement of construction materials (RII = 0.6273)”.
2. Equipment related factors having the factors “Equipment allocation problem (RII = 0.8091)”, “Inadequate contractor experience (RII= 0.6727)”.

3. Contractor related factors of schedule delay factors took place as the third most important group. The outstanding factors were “shortage of construction materials (RII = 0.7727)”, “Inadequate project management assistance (RII = 0.7364)”.
4. After the contractor, the consultant related factors having the factors “Poor site management and supervision (RII = 0.7636)”, “Poor communication and coordination with other parties (RII =0.7455)”.
5. Fifth importance factor was the design related factors. The prominent factors were “Unclear and inadequate details in drawings (RII =0.7091)”, “Ineffective project planning and scheduling (RII =0.6818)”.
6. The owner related factors of schedule delay factors ranked as the seventh most important group. The notice able factors were “unclear and inadequate details in drawings (RII =0.6636)”, “Shortage of labor (RII = 0.6182)”.
7. After the owner, the project related factors having the factors “Legal disputes between project participants (RII =0.6545)”, “Insufficient data collection and survey before design (RII= 0.6455)”.
8. Eight important factors was the external related factor. The Prominent factor were “Lack of experience of owner in construction projects (RII =0.6091)”.
9. The material related factor was the last and the least

important group. The noticeable factor were “Late delivery of materials (RII =0.59091)”.

The results of this paper have demonstrated the ranking of the factors and groups according to their importance level on schedule delay by using relative importance index (RII) method.

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