

Causes and Effects of Construction Project Delays in Nigerian Construction Industry

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Abstract

Construction project delays have been a topic of concern in the construction industry. It can be defined as the late completion of works as compared to the planned schedule or contract schedule. Delays can be minimized only when their causes are identified. The main aim of the study was to identify the major causes of construction project delays, the effects of delays and methods of minimizing delays in construction projects. Questionnaire survey and literature review were used to carry out the study. A total of fifty seven factors and eight groups that contributed to the causes of delays, six factors that affect delays and thirty-five methods of minimizing construction delays were identified. The questionnaires were distributed to the targeted respondents in South-East Nigeria. The data collected were presented in tables and analyzed using Spearman's Rank Correlation Coefficient. The following findings were made: (1) The top ten most important factors that contributed to the causes of delays are: Insufficient number of equipment, inaccurate time estimate, interim payment difficulties, change orders, inaccurate cost estimate, poor site management and supervision, inadequate modern equipment, shortage of construction materials, incompetent project team, improper project planning and scheduling and contractors' financial difficulties. Contractors related delays was ranked the most significant groups that cause delays, followed by equipment related delays, material related delays and labour related delays. (2) Time and cost overruns were the most common effects of delays in construction project. (3) Method of minimizing construction delays include: ensure adequate and available source of finance, competent project manager, availability of resources, frequent progress meeting, award of bids to the right/experience consultant and contractor, use of experienced subcontractors and suppliers etc. The researcher made the following recommendations: (1) Improvement of contractors' managerial skills by continuous working training programs for personnel in the industry to update their knowledge and be familiar with project management techniques and processes. (2) Participatory program for the development of construction industry. (3) Award of contracts should be to experienced contractors and consultants with a good track records and bottlenecks in interim payments should be eliminated. (4) There is the need to increase construction productivity, followed by enhancing the expertise and skill of human resources and conduct of site meetings more frequently.

Key words: Construction, Project delays, Construction Industry, Contractors, Clients, and Consultants.

Introduction

A successful construction project is generally acknowledged to be the one completed on time, within budget, in accordance with the specifications and to stakeholders' satisfaction. Project success can also be measured in terms of functionality, profitability to contractors, absence of claims and court proceeding, and fitness of purpose for occupiers.

One of the most important problems in the construction project is delays. Delays occur in every construction project and the magnitude of these delays varies considerably from project to project, some projects are only a few days behind the schedule, some are delayed for over a year. It is therefore essential to define the actual causes of delays in order to minimize and avoid the delays in any construction project.

Delays can be described as a situation whereby the contractor, consultant and client jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. Delays give rise to discretion of work and loss of productivity, late completion of project, increase time related cost, third party claims and abandonment or termination of contract. It is important that management should keep track of project progress to minimize the possibility of delay occurrence or identify it at early stages.

Causes of Construction Delays

Delays of a construction project can be defined as the late completion of work as compared to the planned schedule or contract schedule. When the project period is delayed, it means the project cannot be completed within original schedule. Delays in construction project will lead to either extension of time, non-completion, termination of contract, total abandonment or a combination of two or more of the factors mentioned.

The duration of a construction project is an important factor to set forth when entering into a construction agreement. If a contractor works with a planned parameter, he or she should be able to finish the construction project in a timely manner. However, compared to other industries, it is difficult to complete a construction project in which many construction trades participate and numerous unknown variables exist. When such difficulties arise, construction schedules are delayed and consequently delay claims occurs. Delays in construction may be caused by the client, the contractor, the consultants, acts of God or third party. They may occur early or late in the job, alone or with other delays. Delays can be minimized when their causes are identified. Identification of the factors that contributed to the causes of delays has been studied by numerous researchers in several countries. Delay is a situation when the contractor, consultant and client jointly or severally contributed to the non-completion of the project within the original or stipulated or agreed contract period.

There are many factors that contributed to causes of delays in construction project. These range from factors inherent in the technology and its management, to those resulting from the physical, social and financial environment. Assaf et al (1995) studied the causes of delays in large construction projects in Saudi Arabia. In the study, the most important causes of delay include: approval of shop drawings, delays in payment to contractors and the resulting cash problems during construction, design changes, conflicts in work schedules of subcontractors, slow decision making and executive bureaucracy in owner's organizations, design errors, labour shortage and inadequate labour skills.

Ahmed et al (2005), in their own study on the construction delays in Florida identified the followings as the most critical causes of delays: Building permits approval, change order, changes in drawings, incomplete documents, inspections, changes in specifications, decision during development stage, shop drawings approval, design development and changes of laws/regulations.

Ogunlana et al (1996) studied the delays in building project in Thailand, as an example of developing economies. They concluded that the problems of the construction industry in developing economies could be rested in three layers: (1) Problem of shortages or inadequacies in industry infrastructure, mainly supply of supply of resources. (2) Problems caused by clients and consultants. (3) Problems caused by incompetence of contractors. They were classified as sources and causes of delays into six groups:

- Owners related factors include change orders and slow decision making
- Design related factors include incomplete drawings and low response
- Construction manager or inspector related factors include deficiencies in organization, deficiencies in coordination and uncompromising attitude.
- Contractors' related factors include materials management problem, deficiencies in organization, coordination deficiencies, planning and scheduling problems, equipment allocation problems, financial difficulties and inadequacy of site supervision.
- Resources suppliers related factors include shortage of construction materials, late delivery, price escalation, low quality of materials, shortage of site workers, shortage of technical personnel, insufficient number of equipment and frequent equipment breakdown.
- Other factors include confined site, problems with neighbours and slow permits by government agencies.

Mansfield, et al (1994) studied the causes of delay and cost overrun in construction projects in Nigeria. The results showed that the most important factors are financing and payment for completed works, poor contract management, changes in site conditions, shortage of materials and improper planning.

Al-Kharashi and Skitmore (2009) carried out a study on cause of delays in Saudi Arabia public sector construction projects. They grouped the possible causes of delays into seven groups: client, contractor, consultant, material, labour, contract and relationship related issues. In general however, it is found that the most influencing current cause of delay is lack of qualified and experienced personnel attributed to the undersupply of manpower in the industry.

Al-Tabtabai (2002) studied the causes of delays in construction projects in Kuwait. He categorized the causes of delays into eight major groups: Client administration and organizational, client site supervision, contractor related, labour related, quality related, design related, project management and contractual related. The results suggest that delays are attributed to poor project management factors and client's administration and site supervision practices.

Ellis and Thomas (2002) carried a study on the root causes of delays in highway construction. They identified the followings as the root causes of highway construction delays: Business as usual, lack of accountability for timely project completion, construction expertise is not incorporated into the design, utilities are unidentified or incorrectly located, delays in the inaccurate information, conditions change after the design is completed, inadequate planning by contractor, inadequate scheduling by contractor and maintenance of traffic (MOT) designs focus on traffic management and often are lacking with regard to constructability.

Root causes of delays were defined as situations or conditions that violated the fundamental principles and were defined in sufficient detail that allowed corrective action to be taken.

Mezher and Tawil (1998) conducted a survey of the causes of delays in the construction industry in Lebanon from the view point of owners,, contractors and architectural/engineering firms. It was found that owners had more concerns with regard to financial issues, contractor regarded contractual relationship the most important, while consultants considered project management issues to be the most important causes of delays.

Chan and Kumaraswamy (1996) surveyed the causes of construction delays in Hong Kong as seen by clients, contractors and consultants, and examined the factors affecting productivity. The results of their research indicate that five principal and common causes of delays are:

- Poor site management and supervision
- Unforeseen ground conditions
- Low speed of decision making involving all project team.
- Client initiated variations.
- Necessary variation of works.

These causes were categorized into the following eight groups:

- Project – related factors include project characteristics, necessary variations, communication among the various parties, speed of decision making involving all project teams and ground conditions.
- Client-related factors include those concerned with client characteristics, project financing, their variations and requirements, and interim payments to contractors.
- Design team-related factors include design team experience, project design complexity, and mistakes and delays in (producing) design documents.
- Contractor related factors include contractor experience in planning and controlling the projects, site management and supervision, degree of subcontracting, and their cash flow.
- Materials related factors include shortage/materials changes, procurement programming and proportion of off-site prefabrication.
- Labour related factors include: labour shortage, low skill levels, weak motivation, and low productivity.
- Plant/equipment related factors include: shortages, low efficiency, breakdowns and wrong selection.
- External factors include: waiting time for approval of drawings, test samples of materials, environmental concerns and restrictions.

Identified Factors that Cause Delays

A project may be delayed for a large number of reasons (factors). The following factors were identified to have influence on construction project delays through books, conference proceedings, the internet, site visits, contractors, clients, consultants and journals.

Materials Related Factors

- Shortage of materials
- Poor quality of materials
- Poor procurement of materials
- Unreliable suppliers
- Late delivery of materials

- Escalation of material prices
- Importation of materials

Labour Related Factors

- Slow mobilization of labour
- Shortage of skilled labour
- Labour productivity
- Labour supply
- Absenteeism
- Strike
- Low motivation and morale

Finance Related Factors

- Inadequate fund allocation
- High interest rate
- Contractor's financial difficulties
- Client's financial difficulties
- Unreasonable constraints of client
- Delay payments to suppliers/subcontractors
- Interim payment difficulties

Equipment Related Factors

- Insufficient number of equipment
- Frequent equipment breakdown
- Shortage of equipment parts
- Improper equipment
- Slow mobilization of equipment
- Equipment allocation problem
- Inadequate modern equipment

Contractor Related Factors

- Inadequate contractor experience
- Inappropriate construction methods
- Inaccurate time estimate
- Inaccurate cost estimate
- Poor site management and supervision
- Improper project planning and scheduling
- Incompetent project team
- Unreliable subcontractor
- Obsolete technology

Client Related Factors

- Slow decision making by client
- Lack of experience of client in construction
- Change orders
- Client interference
- Lack of capable representative
- Lack of communication and coordination
- Improper project feasibility study

Consultant Related Factors

- Inadequate consultant experience
- Poor design and delays in design
- Inadequate project management assistance
- Slow response and poor inspection
- Incomplete drawings/detailed design
- Inaccurate site investigation

External Related Factors

- Unforeseen ground condition
- Unexpected geological condition
- Inflation/prices fluctuation
- Slow site clearance
- Problem with neighbours
- Weather conditions
- Conflict, war and public enemy.

Effects of Construction Delays

Delays can give rise to disruption of work and loss of productivity, late completion of project, increased time related costs and third party claims and abandonment or termination of contract. Aibinu and Jagboro (2002) studied the effects of construction delays on project delivery in Nigerian construction industry. The six effects identified were: time-overrun, cost-overrun, dispute, arbitration, total abandonment and litigation.

Minimizing Construction Delays

The success of construction projects is very important for all project participants as well as the community and the nation to sustain national development. However, several factors affect whether or not a project is completed successfully.

Many researchers conducted studies, recommended and identified the methods of minimizing delays in construction projects. Nguyen, et al (2004) studied the project success factors in large construction projects in Vietnam. The following factors were identified as methods of minimizing construction project delays:

- ^ Competent project manager
- ^ Multidisciplinary/competent project team
- ^ Availability of resources
- ^ Commitment to projects
- ^ Frequent progress meeting
- ^ Accurate initial cost estimates
- ^ Accurate initial time estimates
- ^ Awarding bids to the right/experienced consultants and contractors
- ^ Community involvement
- ^ Systematic control mechanism
- ^ Comprehensive contract documentation
- ^ Effective strategic planning
- ^ Clear information and communication channels
- ^ Use of up-to-date technology
- ^ Absence of bureaucracy

Aibinu and Jagboro (2002) identified two methods to minimize or if possible eliminate time overrun: acceleration of site activities and contingency allowance.

Based on several studies of project success factors and minimizing delays in construction projects, a total of thirty five methods have been identified in order to minimize construction project delays:

- Competent project manager
- Ensure adequate and available sources of finance
- Multidisciplinary/competent project team
- Availability of resources
- Commitment to project
- Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors.
- Adopting new approaches to contracting such as Design-Build and Construction Management (CM) type of contract.
- Complete and accurate project feasibility study and site investigation.
- Acceleration of site clearance
- Comprehensive contract documentation
- Frequent progress meeting
- Project management assistance
- Up-to-date technology utilization
- Use of experience subcontractors and suppliers
- Complete and proper design at the right time
- Competent personnel of consultant/designer
- Competent and capable client's representative
- Site management and supervision
- Use of proper and modern construction equipment
- Proper project planning and scheduling
- Accurate initial cost estimates
- Use of appropriate construction methods
- Community involvement
- Proper emphasis on past experience
- Frequent coordination between the parties involved
- Absence of bureaucracy
- Clear information and communication channels
- Accurate initial time estimates
- Proper material procurement
- Developing human resources in the construction industry through proper training
- Allocation of sufficient time and money at the design phase
- Awarding bids to the right/experienced consultants and contractors
- Perform a pre-construction planning of project tasks and resources needed
- Systematic control mechanism
- Effective strategic planning.

Data Presentation and Analysis

The data collected from the questionnaire survey were presented in tables, and statistically analyzed using percentages, relative importance index (1) and spearman’s rank correlation coefficient.

Table 1: Questionnaire Distribution

Description	Number Distributed	Number Correctly Filled and Returned	Percentage Returned (%)
Contractors	50	45	45
Consultants	50	46	46
Total	100	91	91

Source: Field Survey 2015.

From table 1 above a total 91 questionnaires were correctly filled and returned out of 100 questionnaires distributed to both contractors and consultants representing 91%.

Table 2: Material Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Shortage of construction materials	4.20	1	4.24	1	0	0
poor quality of construction materials	3.70	5	3.73	5	0	0
Poor procurement of construction materials	3.85	4	3.60	7	3	9
Importation of construction materials	3.89	3	3.82	3	0	0
Escalation of material prices	3.57	6	3.71	6	0	0
Late delivery of materials	4.09	2	3.96	2	0	0
Unreliable supplies	3.07	7	3.76	4	3	9

Source: Field Survey 2015.

$$\begin{aligned}
 r_s &= \frac{1-6 \sum d^2}{N(N^2-1)} \\
 &= \frac{1-6(18)}{7(7^2-1)} \\
 &= \frac{1-108}{7(49-1)} \\
 &= \frac{1-108}{7(48)} \\
 &= \frac{1-108}{336} \\
 &= 1-0.3214285 \\
 &= 0.6785714 \\
 r_s &= 0.68
 \end{aligned}$$

To test for significant of r_s

Ho: No significant correlation in the ranking among the two groups.

Hi: There is significant correlation in the ranking among the two groups.

Level of significance (σ) = 5%

$$\therefore \text{drs} = \sqrt{n-1}$$

for the data above 1

$$Z\sigma/2 \text{ drs} = 1.96\sqrt{7-1}$$

$$= (1.96) = (0.41) = 0.80$$

Decision: The null hypothesis is accepted since the value of $r_s = 0.68 < z = 0.80$ at 0.5. We therefore conclude that there is no significant correlation between the ranking of the two groups.

Table 3: Labour Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Slow mobilization of labour	3.85	4	3.76	4	0	0
Shortage of skilled labour	4.04	2	3.98	2	0	0
Labour productivity	4.11	1	4.00	1	0	0
Labour supply	4.00	3	3.89	3	0	0
Absenteeism	3.09	7	3.71	5	2	4
Strike	3.30	6	3.31	7	1	1
Low motivation/morale	3.35	5	3.69	6	1	1
						6

Source: Field Survey 2015.

Spearman’s rank correlation coefficient (r_s)

$$r_s = \frac{1-6 \sum d^2}{N(N^2-1)}$$

$$= \frac{1-6(6)}{7(49-1)} = \frac{1-36}{336} = 0.893$$

$$r_s = 0.893$$

Decision: The null hypothesis is rejected since the value of $r_s = 893 > Z = 0.80$ at 0.05. the researcher therefore conclude that there is significant correlation in the ranking of the two groups. That means the two groups agreed that the factors in table 3 above are the causes of labour related delays.

Table 4: Equipment Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Insufficient number of equipment	4.46	1	4.40	1	0	0
Frequent equipment breakdown	4.13	3	4.93	3	0	0

Shortage of equipment parts	3.30	7	3.76	4	3	9
Improper equipment	3.59	6	3.73	5	1	1
Slow mobilization of equipment	3.87	4	3.73	5	1	1
Equipment allocation problem	3.85	5	3.76	4	1	1
Inadequate modern equipment	4.33	2	4.18	2	0	
						12

Source: Field Survey 2015.

Spearman’s rank correlation coefficient (r_s)

$$r_s = \frac{1-6 \sum d^2}{N(N^2-1)}$$

$$= \frac{1-6(12)}{7(72-1)} = \frac{1-72}{336} = 0.786$$

Decision: The null hypothesis is accepted since value of $r_s = 0.786 < Z = 0.80$ at 0.05. Therefore, there is no significant correlation in the ranking of the two groups.

Table 5: Finance Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Inadequate fund allocation	3.85	3	3.75	3	0	0
High interest rate	3.57	5	3.76	3	2	4
Contractor’s financial difficulties	4.26	2	4.04	2	0	0
Client’s financial difficulties	3.02	7	3.69	5	2	4
Unreasonable constraints to clients	3.70	4	3.71	4	0	0
Delay payment to suppliers/subcontractors	3.09	6	3.64	6	0	0
Monthly payment difficulties	4.43	1	4.29	1	0	0
						12

Source: Field Survey 2015.

Spearman’s rank correlation coefficient (r_s)

$$r_s = \frac{1-6 \sum d^2}{N(N^2-1)}$$

$$= \frac{1-6(8)}{7(7^2-1)} = \frac{1-48}{336} = 0.857$$

Decision: Null hypothesis is rejected since the value of $r_s = 0.857 > Z = 0.80$ at 0.05. Therefore, there is significant correlation in the ranking of the two groups. The two groups agreed that the factors in table 5 above are the causes of finance related delays.

Table 6: Contractors Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Inadequate contractor experience	3.83	8	3.73	8	0	0

Inappropriate construction methods	4.22	6	4.07	7	1	1
Inaccurate time estimating	4.48	1	4.36	1	0	0
Inaccurate cost estimating	4.35	2	4.27	2	0	0
Poor site management and supervision	4.30	3	4.22	3	0	0
Improper project planning and scheduling	3.24	5	4.13	5	0	0
Incompetent project team	4.28	4	4.16	4	0	1
Unreliable subcontractor	4.17	7	4.11	6	1	0
Obsolete technology	3.26	9	3.4	9	0	2

Source: Field Survey 2015.

$$\begin{aligned}
 r_s &= \frac{1-6 \sum d^2}{N(N^2-1)} \\
 &= \frac{1-6(2)}{9(9^2-1)} \\
 &= \frac{1-12}{720} = 0.983
 \end{aligned}$$

For the data in table 6 above

$$\begin{aligned}
 Z_{\sigma/2} dr_s &= 1.96 \frac{1}{\sqrt{N-1}} \\
 &= 1.96 \frac{1}{\sqrt{9-1}} = 0.693
 \end{aligned}$$

Decision: The null hypothesis is rejected since the value of $r_s = 0.983 > Z = 0.693$ at 0.05. Therefore, there is significant correlation in the ranking of the two groups. The two groups therefore agreed that the causes of contractor related delays are as stated in table 6.

Table 7: Client Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Slow decision making by client	3.96	3	3.87	2	1	1
Lack of experience of client in construction	3.91	4	3.78	4	0	0
Change orders	4.39	1	4.31	1	0	0
Clients interference	3.48	7	3.73	6	1	1
Lack of capable representative	3.85	5	3.76	5	0	0
Lack of communication and coordination	4.02	2	3.80	3	1	1
Improper project feasibility	3.80	6	3.71	7	1	1
						4

Source: Field Survey 2015.

$$\begin{aligned}
 r_s &= \frac{1-6 \sum d^2}{N(N^2-1)} \\
 &= \frac{1-6(4)}{1-24} = 0.929
 \end{aligned}$$

$$7(7^2-1) \quad 336$$

Decision: Here null hypothesis is rejected since the value of $r_s = 0.929 > Z = 0.80$ at 0.05. Therefore, there is significant correlation in the ranking of the two groups. Both groups therefore agreed that the factors in table 7 above are the causes of client related delays.

Table 8: Consultant Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Inadequate consultant experience	3.43	6	3.73	4	2	4
Poor design and delays in design	3.98	1	4.02	1	0	0
Inadequate project management assistance	3.76	3	3.76	3	0	0
Slow response and poor inspection	3.93	2	3.84	2	0	0
Incomplete drawing/detail design	3.52	4	3.76	3	1	1
Inaccurate site investigation	3.46	5	3.71	5	0	0
						5

Source: Field Survey 2015.

$$r_s = \frac{1-6 \sum d^2}{N(N^2-1)}$$

$$r_s = \frac{1-6(5)}{6(35)}$$

$$= \frac{1-30}{210} = 0.857$$

For the data in table 8 above

$$Z\sigma/2dr_s = \frac{1}{1.96 \sqrt{N-1}}$$

$$= \frac{1}{1.96 \sqrt{6-1}} = 0.877$$

Decision: The null hypothesis is accepted since the value of $r_s = 0.857 < Z = 0.877$ at 0.05. Therefore, there is no significant correlation between the ranking of the two groups.

Table 9: External Related Delays

Factors	Consultant		Contractor		d	d ²
	Index	Rank	Index	Rank		
Unforeseen ground condition	3.83	2	3.73	3	1	1
Unexpected geological	3.80	3	3.73	3	0	0
Inflation/prices fluctuation	3.83	2	3.71	4	2	4
Slow site clearance	4.07	1	3.91	1	0	0
Problem with neighbours	3.17	6	3.73	3	3	9
Weather condition	3.59	5	3.76	2	3	9
Conflict, war and public enemy	3.76	4	3.73	3	1	1
						24

Source: Field Survey 2015.

$$r_s = \frac{1-6 \sum d^2}{N(N^2-1)}$$

$$= \frac{N(N^2 - 1)}{1 - 6(24)} = \frac{1 - 144}{7(48)} = 0.571$$

Decision: Null hypothesis is accepted since the value of $r_s = 0.571 < Z = 0.800$ at 0.05 level of significant. Therefore, there is no significant correlation between the ranking of the two groups.

Table 10: Major Causes of Delays Groups

Groups	Consultant		Contractor				Overall	
	Index	Rank	Index	Rank	d	d ²	Mean	Rank
Material	3.76	4	3.83	4	0	0	3.80	7
Labour	3.68	7	3.76	7	0	0	3.72	2
Equipment	3.93	2	3.92	2	0	0	3.93	5
Finance	3.70	6	3.84	5	1	1	3.77	1
Contractor	4.12	1	4.05	1	0	0	4.09	3
Client	3.92	3	3.85	3	0	0	3.89	6
Consultant	3.63	7	3.80	6	1	1	3.74	6
External factor	3.72	5	3.76	7	2	4	6	

Source: Field Survey 2015.

$$r_s = \frac{1 - 6 \sum d^2}{N(N^2 - 1)}$$

$$= \frac{1 - 6(6)}{8(8^2 - 1)}$$

$$1 - \frac{36}{504} = 0.929$$

$$Z\sigma/2 dr_s = 1.96 \frac{1}{N - 1}$$

$$Z = 1.96 \sqrt{\frac{1}{8 - 1}} = \frac{1}{1.96 \sqrt{7}}$$

$$= 0.741$$

Decision: The null hypothesis is rejected since the value of $r_s = 929 > Z = 0.741$ at 0.05 level of significant. Therefore, there is significant correlation in the ranking between contractor and consultant.

Table 11: Overall Ranking of Factors that Cause Delays

S/No	Factors	Consultant	Contractor	Overall	
		Index	Index	Mean	Rank
1	Insufficient number of equipment	4.46	4.40	4.43	1
2	Inaccurate time estimate	4.48	4.36	4.42	2

3	Monthly payment of difficulties	4.43	4.29	4.36	3
4	Change orders	4.39	4.31	4.35	4
5	Inaccurate cost estimate	4.35	4.27	4.31	5
6	Poor site management and supervision	4.30	4.22	4.26	6
7	Inadequate modern equipment	4.33	4.18	4.25	7
8	Shortage of construction materials	4.20	4.24	4.22	8
9	Incompetent project team	4.28	4.16	4.22	8
10	Improper project planning and scheduling	4.22	4.13	4.19	9
11	Contractor's financial difficulties	4.26	4.04	4.15	10
12	Inappropriate construction methods	4.22	4.07	4.14	11
13	Unreliable subcontractor	4.17	4.11	4.14	11
14	Labour productivity	4.11	4.00	4.05	12
15	Frequent equipment breakdown	4.13	3.93	4.03	13
16	Late delivery of materials	4.09	3.96	4.02	14
17	Shortage of skilled labour	4.04	3.98	4.01	15
18	Poor design and delays in design	3.98	4.02	4.00	16
19	Slow site clearance	4.07	3.91	3.99	17
20	Labour supply	4.00	3.89	3.95	18
21	Slow decision making by client	3.96	3.87	3.91	19
22	Lack of communication/coordination	4.02	3.80	3.91	19
23	Slow response and poor inspection	3.93	3.84	3.89	20
24	Importation of construction materials	3.89	3.82	3.86	21
25	Lack of experience of client construction	3.91	3.78	3.85	22
26	Slow mobilization of labour	3.85	3.76	3.80	23
27	Slow mobilization of equipment	3.87	3.73	3.80	23
28	Equipment allocation problem	3.85	3.76	3.80	23
29	Inadequate fund allocation	3.85	3.76	3.80	23
30	Lack of capable representatives	3.85	3.76	3.80	23
31	Inadequate contractor experience	3.83	3.73	3.78	24
32	Unforeseen ground condition	3.80	3.73	3.78	24
33	Unexpected geological condition	3.80	3.73	3.77	25
34	Inflation/prices fluctuation	3.83	3.71	3.77	25
35	Improper project feasibility study	3.80	3.71	3.76	26
36	Inadequate project management assistance	3.76	3.76	3.76	26
37	Conflict/war/public enemy	3.76	3.73	3.75	27
38	Poor procurement of construction materials	3.85	3.60	3.73	28
39	Poor quality of construction	3.70	3.73	3.71	29

	materials				
40	Unreasonable constraints to client	3.70	3.71	3.70	30
41	Weather condition	3.59	3.76	3.67	31
42	Improper equipment	3.59	3.73	3.66	32
43	High interest rate	3.57	3.76	3.66	32
44	Escalation of materials prices	3.57	3.71	3.64	33
45	Incomplete drawing/detail design	3.52	3.76	3.64	33
46	Client’s interference	3.48	3.73	3.60	34
47	Inadequate consultant experience	3.43	3.73	3.58	35
48	Inaccurate site investigation	3.46	3.71	3.58	35
49	Shortage of equipment parts	3.30	3.76	3.53	36
50	Low motivation/morale	3.35	3.69	3.52	37
51	Problem with neighbours	3.17	3.73	3.45	38
52	Unreliable suppliers	3.07	3.76	3.41	39
53	Absenteeism	3.09	3.71	3.40	40
54	Delay payment to supplier/subcontractor	3.09	3.64	3.36	41
55	Client’s financial difficulties	3.02	3.69	3.36	42
56	Obsolete technology	3.26	3.40	3.33	43
57	Strike	3.30	3.31	3.31	44

Source: Field Survey 2015.

Table 12: Effects of Delays

Groups	Consultant		Contractor				Overall	
	Index	Rank	Index	Rank	d	d ²	Mean	Rank
Time overrun	3.67	1	3.51	1	0	0	3.59	1
Cost overrun	2.54	2	2.76	2	0	0	2.65	2
Dispute	2.08	3	1.19	4	1	1	1.64	3
Arbitration	1.04	5	1.03	5	0	0	1.04	5
Litigation	1.02	6	1.01	6	0	0	1.02	6
Total abandonment	1.98	4	1.20	3	1	1	1.59	4

Source: Field Survey 2015.

$$\begin{aligned}
 r_s &= \frac{1-6 \sum d^2}{N(N^2-1)} \\
 &= \frac{1-6(2)}{6(35)} = 1 - \frac{12}{210}
 \end{aligned}$$

For the table 12

$$Z = \frac{1}{1.96\sqrt{5}} = 0.877$$

Decision: The null hypothesis is rejected since the value of $r_s = 0.943 > Z = 0.877$ at 0.05 level of significance. Therefore, there is significant correlation in the ranking of effects of delay factors between respondents of contractors and consultants.

Table 13: Methods of Minimizing Construction Project Delays

S/No	Method	Consultant		Contractor		d	d ²	Overall	
		Index	Rank	Index	Rank			Mean	Rank
1	Competent project manager	4.41	1	4.29	2	1	1	4.35	
2	Ensure adequate and available source of resources	4.37	2	4.38	1	1	1	4.37	
3	Multidisciplinary/competent	4.22	7	4.11	10	3	9	4.16	
4	Availability of resources	4.35	3	4.27	3	0	0	4.31	
5	Commitment to projects	3.72	29	3.73	26	3		3.73	
6	Adopting a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities	3.72	29	3.71	27	2	4	3.71	
7	Adopting new approaches to contracting such as design build and construction management contracting	4.20	8	3.91	18	10	100	4.05	
8	Complete and accurate feasibility study and site investigation	3.93	20	4.04	13	7	49	3.99	
9	Acceleration of site clearance	3.91	21	4.16	8	13	169	4.03	
10	Comprehensive contract documentation	3.78	26	3.71	27	1	1	3.75	
11	Frequent progress meeting	4.30	5	4.24	4	1	1	4.27	
12	Project management assistance	4.09	13	4.09	11	2	4	4.09	
13	Utilization of up to date technology	3.76	27	3.73	26	1	1	3.75	
14	Use of experienced subcontractors and suppliers	4.28	6	4.20	6	0	0	4.24	
15	Complete and proper design at the right time	3.96	19	3.82	22	3	9	3.89	
16	Competent consultant/designer	3.89	22	3.87	20	2	4	3.88	
17	Competent and capable client's representative	4.11	12	4.13	9	3	9	4.12	

18	Site management and supervision	4.04	15	3.96	16	1	1		
19	Use of proper and modern construction equipment	3.98	18	3.98	15	3	9	3.98	
20	Proper project planning and scheduling	3.74	28	3.64	29	1	1	3.69	
21	Accurate initial cost estimates	4.07	14	4.18	7	7	49	4.12	
22	Use of appropriate construction methods	4.15	10	4.07	12	2	4	4.11	
23	Community construction methods	3.72	29	3.69	28	1	1	3.70	
24	Proper emphasis on past experience	3.85	24	3.76	25	1	1	3.80	
25	Frequent coordination between the parties	3.87	23	3.80	23	0	0	3.83	
26	Absence of bureaucracy	3.61	30	3.56	31	1	1	3.58	
27	Clear information and communication channels	3.78	26	3.73	26	0	0	3.76	
28	Accurate initial time estimates	4.00	17	3.84	21	4	16	3.92	
29	Proper material procurement	4.02	16	3.93	17	1	1	3.98	
30	Developing human resources in the construction industry through proper training	3.80	25	3.78	24	1	1	3.79	
31	Allocation of sufficient time and money at the design phase	4.13	11	3.89	19	8	64	4.01	
32	Awarding bids to the right/experience consultant and contractor	4.33	4	4.22	5	1	1	4.27	
33	Perform a preconstruction planning of project task and resources needs	4.17	8	4.02	14	6	36	4.10	
34	Systematic control mechanism	3.78	26	3.73	26	0	0	3.76	
35	Effective strategic planning	3.20	31	3.62	29	2	4	3.41	

Source: Field Survey 2015.

$$r_s = \frac{1-6 \sum d^2}{N(N^2 - 1)}$$

$$= \frac{1 - 6(561)}{33(35^2 - 1)}$$

$$= \frac{1 - 3366}{42840}$$

$$r_s = \underline{921}$$

42840

$$r_s = 921$$

$$Z\sigma/Z dr_s = 1.96 \sqrt{\frac{1}{N-1}}$$

$$\begin{aligned} Z &= 1.96 \sqrt{\frac{1}{35-1}} \\ &= 0.336 \end{aligned}$$

Decision: Null hypothesis (H₀) is rejected the value of $r_s = 921 > Z = 0.336$ at 0.05 level of significant. Therefore, there is significant correlation in the ranking between contractor and consultant in the methods of minimizing construction project delays.

Conclusion and Recommendations

Project delays have been a topic of concern in the construction industry. Delays have become a universal phenomenon and are almost always accompanied by cost and time overruns.

The major aim of this study was to identify the major causes of delays, the effects of delays and the methods of minimizing delays in construction projects. The most important factors that contributed to the causes of delays includes: insufficient numbers of equipment, inaccurate time estimates, interim payment difficulties, change orders, inaccurate cost estimate, poor site management and supervision, inadequate modern equipment, shortage of construction materials, incompetent project team, improper project planning and scheduling, and contractors financial difficulties. These factors were grouped into eight groups of causes of delays. Contractor related delays group was ranked the most significant group that causes delays, followed by equipment related delays, client related delays, finance related delays and labour related delays.

The effects of delays in construction project execution include: time overrun, cost overrun, dispute, arbitration, total abandonment and litigation. Time and cost overruns were the most common effects of delays in construction project.

The most effective methods of minimizing delays include: to ensure adequate and available source of finance until project completion, competent project manager, availability of resources, frequent progress meeting, award of bids to the right/experienced consultants and contractors, use of experienced subcontractors and suppliers, multidisciplinary/competent project team, accurate initial cost estimate, competent and capable client's representative and use of appropriate construction methods.

The following recommendations were made by the researcher in order to alleviate the problems of delays in the construction industry:

- To improve contractors' managerial skill, there is a need for continuous work training programs for personnel in the industry to update their knowledge and be familiar with project management techniques and processes.
- There is the need to formulate and execute a participatory program for the development of the construction industry through a dedicated national agency.

- To reduce construction project delays, there is the need to increase construction productivity, followed by enhancing the expertise and skill of human resources, and conduct site meetings more frequently.
- Award of contracts should be to experienced contractors and consultants with a good track records and bottlenecks in interim payments should be eliminated.

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