

Delays in Construction Projects

VyankateshSumbare¹, Sandeep D Salunke², Dinesh CRodage³, Ajay Dahake⁴

^{1,2,3} U.G Student Civil Department, G H Raison College of Engineering & Management Pune

⁴ Professor Civil Department, G H Raison College of Engineering & Management Pune

Abstract— Construction industry is one of the significant contributors to the economic growth and development of country. The problem of delays in construction sector is global phenomenon. Delay in timely completion is one of the main issues in public sector construction project of developing countries. Delay is a condition where a construction project does not complete within the designed schedule. The occurrence of a delay in the construction project is common and significantly affects by enormous way. This report gives the information about the types, causes, classification of causes and mitigation measures to overcome the delays in construction project. This report provides the conceptual framework of the delays in construction project & how to overcome the issues. The methodology includes the questionnaire to the engineers and the contractors from that basis the causes of delays are arranged/ ranked by the RII (relative importance index). Study shows the most critical effect of the delay on construction is the cost overrun and because of that termination of project happens.

Index Terms: GDP, RII, IPMD, INR, DBB.

I.INTRODUCTION

Construction industry is assumed to be the back bone of for the growth and development of the economy of the any country. It also provides job opportunities to millions of people to work in construction industry. Construction sector is a catalyst for economic growth as it stimulates development in other sectors (Rao Amir Khan and WardaGul, 2017). Construction industry is the second largest and basic input for socio-economic development of our country after agriculture and as per recent information by the sector wise GDP it has contributed 7.55% to the total GDP. It is estimated that about US\$650 billion investment in India will be required for urban infrastructure alone over next 20 years (Planning commission, 2013). Growing population, increasing urbanization and global competition have made it imperative that the infrastructure is developed

rapidly. Despite the advancement of technology, management, and research, this industry has been suffering to achieve the project delivery target within a predefined time, in particular, which is acknowledged as schedule delay. This delay is not only frequent but a regular phenomenon in developing countries.

Since the last two decades construction industry has joined a boom in India. Developments in all sectors are leading towards establishments of new infrastructural projects. Though the industry it at it high, it is aging In proper planning of the projects which leads to negative impaction all the project participants. Delays are the unavoidable part of any project, but efforts shout be token to find what the reasons for the common delays on the project are who is responsible for these delays among the participants, how much was the impact caused?. These impacts go unseen & not much attention is paid towards it in Indian constriction scenario. If the resource is used appropriately as per the planning to complete the activities as scheduled, this will help in reducing the delays & impact caused by it. As it is said “It is better to learn from the mistakes”, the impact could be reduced only when the reasons for the delays are known. The project will help in finding out what are the causes of delays the responsible participants the impact caused by the delay.

Every construction project have their own goal and objective to achieve such as meet the client requirement, cost, achieve the quality needed, finish according to the planning time and others. Though construction projects in India facing various problems, delay in construction is one of the major issues. Construction project delays are a global phenomenon, and India is not an exception. As per the project implementation status report (IPMD, 2018) of Government of India, as on July 2017, out of total of 1,257 ongoing projects (costing INR 1.5bn and more), 274 projects (22 per cent) are suffering

time overrun. Delay is defined as a time overrun beyond the project completion date agreed by the parties. Delay may also be defined as act or event, which extends required time to deliver project (work of the contract), manifests itself as additional days of work.

Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time, frequently in medium and large size projects, and considered severe in small projects. Construction delay has significant negative consequences on project performance in terms of loss of revenue and reputation of the involved parties, and delay to provide intended services of the projects. Delay also creates a caustic situation such as a dispute, ligation, and arbitration between owner and contractor, which sometimes lead to a total abandonment of the project.

When the project gets delayed the progress of the project will be accelerated heavily in order to deliver it on time. Accelerating the process of the project will also affect the quality of the output which sacrifices client's satisfaction. 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. Due to the construction delays not only the client getting their completed project later, but it can also have a major impact on the cost, duration and quality of the project (Dinesh Kumar R 2016) Delay occurs on the almost on the every project also it is non avoidable, but it can be minimized. There is a significant shift in the capacity and volume of the construction sector, which demands the need of a systematic study and assessment of the reasons of project delays along with mitigation measures. Therefore there is a need to identify a universal set of causes of delay that affect construction project performance. In so doing, understanding the trends and investigating the developments in a particular research area is vital (Hong et al., 2012; Tsai and Wen, 2005). This study identifies a common set of construction project delays, effects of construction

project delays along with mitigation measures which may provide a better understanding of the key areas requiring attention where steps should be taken to minimize or control factors causing delays in construction projects.

II. AIM & OBJECTIVES

“The research is aimed at identifying the major causes of delay, effects of delay and methods of minimization delays in construction projects”.

The objectives of this project are :

- 1) To identify the main causes/reasons of construction delay in construction project.
- 2) To identify the measures/ remedies of minimizing construction delay in construction project.

III. LITERATURE REVIEW

All the researchers use the 5-point likert scale to arrange/rank the causes of delays according to their major effect or occurrence.

Berlinda Lessing, Derek Thurnell, Serdar Durdyev focused on main factors causing delays on large construction projects in New Zealand. They mentioned that unforeseen ground condition is a quite significant cause of delays. The design group is most significant in delays through lack of producing document on time, late instruction, and unclear and inadequate details on drawing.

Tsegay Gebrehiwet and Hanbin Luo studied the impact of delays in pre-construction stage, construction stage, post-construction stage. According to their study corruption, unavailability of utilities at site, price increase in material, lack of quality material, late design and design document, slow delivery of materials, late in approving and receiving of complete project work, poor site management and performance, late release of fund, ineffective planning are the main causes of delays in Ethiopian construction projects.

Rao Amir Khan and Warda Gullook toward the identification of critical risk factors causing delays in construction project which are implemented in Islamabad. They classified risk in five categories. They found that the design risk were ranked first, external risk second technical and labour risk were ranked third, and financial risk was ranked fourth that causes the delays.

Akhund, Khoso, et al. gives the detail explanation about the two types of delays: one is excusable delay and second is non-excusable delays.

Thabani Nyoni and Bonga investigate the factors affecting construction delays in Zimbabwe. The result of that investigation shows that progress payment by owner, difficulties in financing the project and change orders are most important factors causing the delays in construction project in Zimbabwe.

Plethora of both local and international research studies conducted on causes of delays in construction projects were reviewed. Evidently, no study has been carried out to examine the delays attributable to the contractors in Sri Lanka, hence there is a potential research gap. Although similar studies have been carried out in other countries, a study devoted to examine the same aspect in the local context is of great importance. This is because of the differences in economic policies, project characteristics, practical problems and resource availability of Sri Lanka in comparison to other countries.

Chan and Kumaraswamy (1998) conducted a study to evaluate the relative importance of 83 potential delay factors associated with construction projects in Hong Kong and found five critical delay factors, namely: poor risk management and supervision, unforeseen site conditions, slow decision making, client-initiated variations, and work variations.

A study was conducted by Jayawardane and Pandita (2003) on the topic of evaluating and mitigating the factors affecting construction delays. According to this study, both contractors and consultants have collectively ranked rainy weather, manpower skill and material shortage as the top ranking causes of construction delays. In order to minimise such delays, the study recommends the following; proper construction planning, cash flow management, human resource development and further training in specialised skills, frequent site meetings and joint site inspections.

Vasugi, Venkatesan, et al., investigate the delay causes in India by project sector (transport, power, buildings and water) and carry out a comparative study of delay causes in design build (DB) projects with that of design bid build (DBB) projects along with mitigation measures. A questionnaire survey was conducted among major clients, contractors and consultants in India. Importance Index was used for

ranking of the delay causes. The research findings indicate finance-related causes as the most critical causes of delay in Indian projects. Delay in settlement of claims, contractor's financial difficulties, delay in payment for extra work/variations by owner, late payment from contractor to subcontractor or suppliers, variation orders/changes of scope by owner during construction and changes in design by owner were the highly ranked delay causes. The research found no significant difference in the delay causes in DB and DBB projects.

Serdar Durdyev and Hosseini present a systematic review of studies on construction project delays published between 1985 and 2018. Before identifying common construction project delays, research trends were examined in terms of the number of publications in selected journals, as well as the contributions made by countries, institutions and researchers. The findings reveal that researchers from developing countries have contributed the most to identifying the causes of construction project delays. A total of 149 causes of construction project delays were identified in a thorough review of 97 selected studies. Weather/climate conditions, poor communication, lack of coordination and conflicts between stakeholders, ineffective or improper planning, material shortages, financial problems, payment delays, equipment/plant shortage, lack of experience/qualification/competence among project stakeholders, labour shortages and poor site management were identified as the ten most common construction project delays.

Singh, Dixit et al., identifies the various attributes for construction project delay, using the residential building projects as a starting point. Feedback from a survey administered to the contractors and consultants was analysed using Relative Importance Index (RII). Results showed that shortage of materials on site; unforeseen ground conditions; poor procurement planning; problems to access the site; rework; weather conditions; inadequate modern equipment; skilled workforce; and equipment failure are ranked by the contractors and consultants as the main causes of project delays in India.

Muhammad Saiful Islam and Suhariad investigate the main causes of delay in privately funded large building projects in Bangladesh. To determine the causes of delay, a structured interview with 70

respondents was conducted with project owners, consultants, and contractors. Using the importance index analysis method, the study identified the critical causes of delays. The ten most important causes are, (1) lack of experienced construction managers; (2) lowest bidder selection; (3) owners' fund shortage; (4) lack of proper management by the owners; (5) improper planning and scheduling; (6) lack of skilled workers; (7) inaccurate time and cost estimation by the contractors; (8) site constraints; (9) improper progress monitoring and cost control; and (10) contractors' cash flow problem during construction. These causes are mostly related to managerial and financial issues, which are similar to the condition in some other developing countries, such as Indian, Pakistan, Vietnam, Egypt, Kuwait, Malaysia, Ghana, and Saudi Arabia.

Prakash Rao, in the study of Alaghbari acknowledged as the most common, costly, complex and risky problem encountered in construction projects. Because of the high importance of time for both the owner (in performance) and the contractor (in terms of money), it is the source of continuous disputes and claims leading to law suits. According to him delays caused by the client such as late submission of drawings and specifications, continuous change orders, and incorrect site information generates claims from both the main contractors and sub-contractors which many times entail lengthy court battles with huge financial problems.

Miterev and Nedelcu in (2011) identified the various causes of construction project delays in our present day. Results of this showed the ten most significant factors namely: poor site management; shortage of skilled labour; unrealistic project scheduling; labour absenteeism; design changes/ rework due to the construction errors; accidents due to poor site safety; subcontractor delays; shortage of materials on site; late delivery of construction materials and effects of bad weather on construction activities.

Rivera, Baguec, et.al., in (2020) on road construction Projects across 25 Developing Countries A study on the factors affecting delays in road construction projects determined that the most severe aspects are human-related. They can be managed and reduced by refining the skills of the construction sides Santoso and Soeng emphasized that delays affect not only the last time of the project but also the cost and quality.

Desalegn Disasa Daba and Pitroda states that delay is a period of late time of project that identified in a contract agreement or greater than the date that contractor and client decided upon submission of a project. It is a project time lag over its planned schedule and is well thought-out as common difficulties in the construction industry.

Dinesh Kumar R. find out the most significant factors causing delays in Indian construction projects. In this paper there are 103 causes of delays categorized into 8 different groups, and 8 effects of delays were found. The major reason behind all these causes is lack of commitment and coordination within the project participants.

Naser S. Almutairi investigate that the causes of delays on Construction Projects in Kuwait according to opinion of engineers working in Kuwait. It is found that the top 10 causes of delays in construction projects in Kuwait. 1) Using a lowest price bidding and tendering system. 2) Poor performance of the main contractor. 3) Inadequate experience or qualifications of main contractor's staff. 4) Delay of payments from client to other parties. 5) Poor performance of subcontractors. 6) Shortage in the supply of general labour. 7) Frequent changes of subcontractors. 8) Delay in decision making by the client. 9) Poor management of subcontractors. 10) Conflict between the main parties to the contract.

Hamzaha, Khoirya, et.al., said that there are two main type of delay, excusable delay and non-excusable delay also they give the information about excusable delay, non-excusable delay, concurrent delay, compensable delay and non-compensable delay and what are causes of these types of delay are also mentioned. Main causes are as contractor's improper planning by contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work and the problems with sub contractors. Moreover shortage in material get the sixth, then labour supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage.

Important delay factors, which caused delays to projects in Saudi Arabia, can be solved with the application of BVA and PIPS. Most importantly, delay factors are solved through phases. These phases have many filters that help owners find good vendors based on their performance. These filters prevent

delays in the construction of public projects in Saudi Arabia by using only select, high-quality contractors. The PIPS process consists of four phases: pre-qualification, selection, clarification, and execution.

IV. METHODOLOGY

Introduction

This research methodology will be described and explained based on the objectives and the aims of the study. In this study, we will focus on the literature review and the questionnaire survey targeted construction project.

Data collection

Data which is obtained from the questionnaires will be used to be analysed with an appropriate method which may result in the success of the research. Data collection from the different type of questionnaire would be analysed and answered to the objective of the study.

A questionnaire survey was designed based on the objectives of the study, which are causes of construction delays, effects of construction delays & effects of lockdown on construction projects. A questionnaire survey was developed to get the opinion and understanding from the experienced respondents regarding to the construction delays problem.

The questionnaire is mainly based on Likert's scale of 5 ordinal measures from 1 to 5 according to level of contributing.

- (5) Strongly Agree
- (4) Agree
- (3) Moderate
- (2) Disagree
- (1) Strongly Disagree

Research questions

1. Does in every work of construction delay occurs?
2. If not, then in how much big project does the delay occurs?
3. What are the general factors that cause the delays?
4. What are main and frequently occurring causes?
5. Does any kind of remedial measures are taken by you to remove that?
6. How do you handle your labour problems?

7. How you take care about any newly coming worker?
8. On what basis you take new workers?
9. We ask them to give the rating (on 5 point likert scale) for the 7-8 main classified causes of delays.

Data analysis

Collected data is used to establish the relative importance index (RII) of the classified group of causes. There are two steps in analysing the data-
1] calculating the RII factor.
2] arranging the causes of delays in ascending order according to the corresponding RII.

Relative Importance Index (RII)

Relative Importance Index method to determine the relative importance of the various causes and effects of delays. Relative importance index (RII) is used here to determine the ranking of factors causing delay to a project as per contractor's or engineer's view. Relative Importance Index is computed as

$$RII = \frac{\sum r \cdot n}{5N}$$

Where-

- r - the rating on a Likert scale (1-5) as for the impact on construction efficiency for a specific element influencing construction profitability.
- n - the number of respondents providing a specific Likert scale rating r
- N - the aggregate number of respondents to a specific question

V. OBSERVATION

Case study 1

- 1 Name of Project – school building and hostel building
- 2 Location – Kalamb, Osmanabad .
- 3 Name of contractor and experience – Mr. K. C. Masakhtri.
- 4 Name of supervising Engineer – Mr. D.G. Satpute

Table 1 Causes of delays and rating

Sr.No.	CAUSES OF DELAYS	RATING(Out of 5)
1.	Owner related factors/ Finance related factors	2
2.	Contractor related	3
3.	Consultant related	1
4.	Designer related	2
5.	Labour related	5

6.	Material contributed	4
7.	Equipment related	3
8.	External conditions	4

Table 2 Stages of construction and occurred causes

STAGES	OCCURRED CAUSES
Pre-construction stage	Land acquisition, unavailability of utilities at site, lack of clear understanding of contract document, resource related causes, etc.
Construction stage	Designer related, contractor related, finance related, labour related, equipment related, material related.
Post-construction stage	Responsibility related, external related, client related, finance related, etc.

Special conditions of the location that can causes the delays other than above causes –

1. Royalty on the material required for the construction
2. Labour unavailability
3. Naxalite problem
4. Ground related (topography, clearing jungle around the site)
5. Weather condition

Effects of lockdown on ongoing constructions and its impact

1. Material price hike
2. Unavailability of materials
3. Labour unavailability
4. Equipment related
5. Travelling problem



VI. RESULTS & DISCUSSION

Results of questionnaire

According to contractors and engineers every work does not faces the delay situation. But the big project or beyond some limit nearly the project cost crossing

30-35 & above lakhs mostly faces the delay problems. Generally labour related, material related, owner related, financial and external factor causes the delay. Among them labour related, material related and weather conditions/ external factors are most frequently and important factors that causes the delays.

To avoid labour related problems they try to give them what they needed (based on some conditions). For material related they buy excess amount of material for a certain site then transfer to required one to the next. But the financial problems of the owner and the external factors are not controlled by the contractor and engineer.

This chapter presents the data analysis and discussions based on the questionnaire survey. The collected data were analysed using the method named relative importance index.

Table 3 Causes of delays and RII value

Causes of delays	RII value
1. owner related factors	0.43
2. contractor related	0.57
3. consultant related	0.32
4. designer related	0.29
5. labour related	0.86
6. material contributed	0.77
7. equipment related	0.57
8. external factors	0.66

As above RII factor for individual classified causes their ranking is as

Rank 1 – labour related causes

Rank 2 – material contributed causes

Rank 3 – external factors

Rank 4 – contractor related & equipment related causes

Rank 5 – owner related causes

Rank 6 – consultant related causes

Rank 7 – designer related causes

Labour risks are ranked as 1st most important risk category affecting project delay. In construction industry labour availability and lack of skilled labour are indicated most important risks affecting project delay by the industry experts in their interviews and most of the respondents while filling questionnaire gave more importance to these risks.

Equipment related causes ranked 2nd for causing the delays. There is always material shortage on the site due to rise & fall in the price of material, also due to the royalty of the material.

In the external factor the most important is that the duration allotted for completion of project is throughout the year but due to the monsoon season the process in that season fails behind. Also along with that unforeseen ground condition, poor site access, design error due to unfamiliar local condition contributes to the external factors causing the delay.

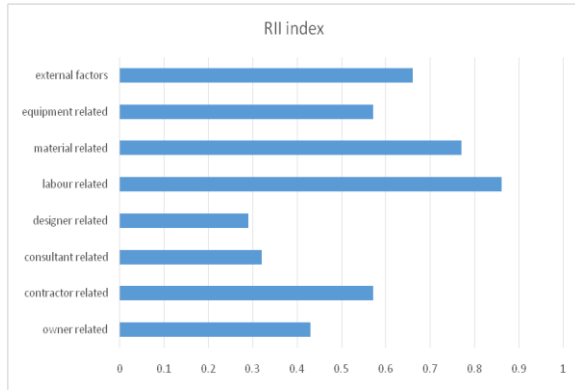


Figure Comparison of factors according to RII

VII. CONCLUSION

This study identifies the causes of delay in construction projects in 7 cities of Maharashtra. A questionnaire survey was used to collect data from the selected population of research. The study fills a gap in knowledge of factors affecting delay in construction projects in studied area, which can be used by project managers and policy makers in developing new intervention strategies aimed at curbing delays and improving construction business performance.

There are two objectives of this study which have been achieved. The first objective was to identify the major causes of delays and the second is methods of minimizing delays; along with that effects of delays in construction projects is studied.

By doing these study on topic delays in construction project we get to know that the most frequently occurring cause for delay is labour related. Nearly every contractor and engineer to whom we are interacted they said that shortage of labour, unskilled labour, high labour wages and language difference between labour is the most imp. and frequent occurring cause.

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