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CRITICAL DELAY DRIVERS IN FAST TRACK CONSTRUCTION PROJECTS

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DEDICATION

We would like to dedicate our works to our parents, our teachers our institution NUST and all our friends. We executed our work with the impressive assurance and determination and applied best of ourselves to the errand at hand.

DECLARATION

It is hereby reverently and truthfully declared that all the work alluded to this thesis is composed by us and it has not been submitted by any institution, in whole or in part in any previous application for a degree. Any references to the work done by any other person or University have been appropriately cited.

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In the name of Allah, the most Beneficent, the most Merciful as well as peace and blessings be upon Prophet Muhammad, His servant and final messenger.

We are thankful to Allah almighty for bestowing us an opportunity to be here in a prestigious institute and intellectual strength with continuous guidance to work up to the mark.

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ABSTRACT

Construction delays are one of the major concerns for the stakeholders involved in the construction industry. Our effort was to determine various kinds of delay drivers and then analyzing them. We used three approaches in order to determine the delay drivers in the construction industry. First one was the event sequence mapping technique that assisted us in the evaluation of critical delay drivers. Then questionnaire survey was conducted among the professionals involved in the industry. The third one was the subjective case study of specific public sector projects. Then a list of delay drivers were obtained and classification of those was done on the basis of Relative Importance Index (RII). At last the most critical delay drivers were determined on the basis of results obtained.

Chapter 01

INTRODUCTION

1.1BACKGROUND

The lengthening of the project's completion time is what we mean by "delays" in the construction industry. To put it another way, a delay occurs when the project is not completed by the agreed-upon deadline and within the agreed-upon budget. In the construction sector, construction delays are a common occurrence, and they can have a negative impact on the timeliness, cost, and quality of a project. When a project fails, it is most often due to the impact of consultants, contractors, and the project owner on its success. When a project is delayed, it costs everyone involved money and frequently leads to disagreements, overruns in costs and time, arbitration and litigation as well as complete project abandonment due to infeasibility. Because of the many external and internal elements that impact the building process, construction is a dangerous business.

The overall success or failure of the product is influenced by critical delay causes. For the sake of creating an original product, service, or end result, construction projects are short-term, time- and cost-bound endeavours. In order to establish a unique construction on a specific site under unique conditions, the project-team gets together. Delays in the building process are prevalent because of the numerous uncertainties involved in these projects and the need for a high degree of coordination between the many parties involved. It is significantly more challenging to keep a job on time when new technology and owner-requested adjustments are involved. Inherent uncertainties in the environmental, financial, and economic environments in which the majority of undertakings are carried out go hand in hand with this situation. Due to these circumstances, it has become more difficult to complete projects on time and under budget, leading to many requests for cost reimbursements and time extensions. Any time a project is running behind schedule, whether it is because of late completion or a late start, it is termed a delay in construction and has a direct impact on cost estimates. Delays caused by fines, higher costs owing to inflation, contract cancellation or combinations of the above described circumstances will result in delays damages.

Effects of delay in construction projects

It is possible to identify, assess, and manage the risk of construction delays from the beginning of a project so that they may be avoided or accepted in order to get some positive outcomes and avoid subsequent delays. Clients, contractors, and specialists all suffer as a result of construction delays in terms of increased antagonistic relationships, distrust, litigation and arbitration. A construction project is not considered a success unless it meets the budget, schedule, and quality standards that were set for it. While it is not unusual for a construction project to fall short of its stated goals in terms of cost, schedule, and quality, it is not unheard of. The use of "Construction Contract Management" is used in order to minimise the occurrence of unplanned delays. Constructing a project needs the use of project management knowledge, skills, tools, and procedures, all of which must be coordinated in order to be successful.

Processes in Construction Project Management

Construction In the world of project management, there are five kinds of processes known as Project Management Process Groups.
Initiating the project and developing a project plan
Execution of the project
Monitoring & Control of the project
Closing of the project Project Monitoring & Control is responsible for identifying and analysing delays.

Delays may be eliminated by working together as a team and conducting thorough investigations.
c. Careful and routine monitoring and meetings are necessary.
d. A well-run business.
The ability to work together effectively and cooperatively is a key component of this position.

f. Careful scheduling.

Types of Delays in Construction Projects

Before assessing construction delays, it is vital to know what kind of delay they are. A good grasp of the many sorts of delays is required to begin the mitigation efforts and turn it into a merit. There are four primary methods to classify delays:

A) Serious or inconsequential lag time

If there are delays, they may be excused or not.

Consecutive holdups

Delays that may be compensated or that cannot be compensated

Before estimating the effect of delays on the project, it is also necessary to comprehend the amalgamation between the various categories.

- Determine if the postponement is critical versus non-critical
- Every delay is either acceptable or unacceptable.
- Both understandable and non-excusable delays may be categorised as concurrent or non-concurrent, depending on their severity.
- Noncompensable and compensable delays are further subdivided..

Robert E. Wright:
Development challenges are exacerbated by bid gambling, change order creativity, lack of knowledge, and market power in the post-contractual period according to Robert E. Wright, an economic historian at the University of Chicago. Many bespoke housing developments will continue to go over budget, be late, or fall short of contract requirements unless these underlying concerns are addressed and fixed.

B) Critical or non-critical Delays:

A crucial delay is one that contributes to the overall lengthening of the project. The following is a list of some of the findings:

- The Field Overhead is extended.
- Damage to property caused by unabsorbed home office expenses
- A rise in the cost of materials and labour due to inactivity.

A non-critical delay is one that does not result in an extension of the project's length; rather, it would have an impact on the completion of tasks later than expected. As detailed below, these actions will also have an impact on the project's cost projections.

Costs of idle labour and equipment b) Increases in the cost of labour and materials c) And so on.

Explanable and inexplicable delays

It is acceptable for a contractor to be late when the contract stipulates that the party is entitled to additional time or pay or both. In this situation, the contractor has no influence over the delay. The following are possible reasons;

1. Measures of Force
2. Disasters Caused by Mother Nature
3. Unrest in the political and social arenas
4. Attacks by Terrorists
5. client delays (approvals, decisions, etc.), and so on.

- Non-excusable delays occur when the contractor is solely to blame for the operations that were delayed and, as a consequence, caused the project's completion date to be extended. As a result, the contractor has the risk of financial implications, including the potential duty to pay damages not just to itself but to the other individuals as well. Why is this happening?
- Postponed Deployment
- Procurement Delays
- a lack of timely delivery of critical papers
- Planned and timetabled activities
- Events that should have been brought to the attention of the client but weren't.

C) Concurrent Delays in Construction Projects

A concurrent delay arises when various delays co - occur and influence different activities concurrently and separately. Not all of these occurrences, however, provide the contractor the right to a claim for time and expense extensions.

Either compensable or non-compensable When a contractor is responsible for Time Extension and Cost Compensation in a construction project scenario, delays that occur are compensable delays. Excusable delays include any delays that may be compensated for, but non-compensable delays are those that are completely the contractor's responsibility. The scenario it has produced and the contract circumstances determine if non-compensable is critical, non-critical, excusable, or not.

Early warning:

The contractor shall notify the contract administrator in writing if there is a delay or if it seems that there may be a delay that warrants an extension of time.

The parties involved in the project must notify each other as soon as possible of any potential delays. Next, a meeting to examine potential project consequences should be convened as soon as possible.

1.2 PROBLEM STATEMENT

This information comes from the minutes of meetings, progress reports, project Primavera timeframes and other sources. The following problem statements have been identified based on this data:

Here's what they had to say about it:

A) The performance of a project suffers greatly when delays occur on a regular basis:

Even in wealthy and developing nations, delays in the fulfilment of work contracts are still a recurrent problem or frequent occurrence in engineering projects that often occur from conception to completion. Legal conflicts, rising costs, poor service quality (including arbitrage), overruns in the deadline for completing the job or ending the project, and so on are all possible results of a breakdown in communication between the parties involved in the project.

Construction delays are a fact that affects not only the industry, but also nations' economies, resulting in a negative impact on the project's success response to fluctuations in the original lethal injection schedule, as well as the costs, quality attributes and strategic planning of safety conditions that were previously established; thus, the project's success is negatively affected. Construction delays may have a significant financial and social effect on all of the project's stakeholders, since this is a major issue in construction management. Due to a lack of resources and a tendency to overspend, this issue is particularly prevalent in poor nations. There is a wide variance in the causes of delays in various nations, and the events considered as crucial in developing countries vary greatly from those in rich countries.

Our issue statement, " Frequent Occurring of Delays," is supported by the following data:

Figures from the Brazilian Coordination Committee (ABC) show that between 2005 and 2010, the number of delays in So Paulo construction projects increased by 65 percent. In addition, a study by Tapai Advogados, a real estate legal firm, found that the number of litigation against So Paulo construction businesses increased 2,600 percent among 2008 and 2013, from 140 new cases to 3,779, in only five years. This is supported by Maués et al. (2017a), who point out that the performance of the construction business is much weaker when it comes to reaching contractual deadlines than other companies, such as the production one. More over one-third of 142 projects studied in the Brazilian Amazon area

between 2005 and 2015 were unable to meet their initial deadlines; this equated to 116 projects being delivered beyond the due date. It is possible to point to other nations, such as Iran, where delays in construction from 2002 to 2012 cost Iran's government around US $ 21 billion; the Iranian statistics centre (SAMARGHANDI et al., 2016). During the period from 2000 and 2013, public projects in Qatar saw a 54% extra cost and a 72% increase in delays, according to Senouci, Ismail, and Eldin (2016). Additionally, in the case of establishing maintenance services, the costs and delays increased by 50%. According to research on the possible causes of delays in construction projects conducted by Mukuka, Aigboa and Thwala (2015) and Satish et al. (2018), for example, the construction sector in South Africa and India faces challenges in delivering work within in the contract terms deadline and the relevance of mitigation measures.

As Hsu et al. (2017) note, engineering projects are plagued by several difficulties due to project delays, and these difficulties may have a significant impact on project completion. As a result of this, it is critical to identify and address the root causes of delays in order to prevent recurrences of delays in the future. It is also important to identify the major reasons of delays in work in order to develop effective ways for mitigating their implications, such as the extrapolation of expenses. As a result, it is important to identify the primary causes of delays and take preventative actions to limit the effects of such events. Construction delays analysis is still significant for the industry, regardless of past studies of current management systems or the competence of engineers, according to Guszak and Lesniak (2015) and Kowalczyk et al. (2018). But according to Alsehaimi et al. (2012), despite the fact that many studies have been done on delays, they do not have objective recommendations on how to increase the action plans needed to manage a project; in furthermore, the solutions proposed are usually of a generalist nature and do not specifically treat the cause of delay.

There can be no doubt from the facts and data above that delays have a detrimental influence on the overall development of a project, which may have catastrophic results.

B) Time and Cost Over runs:

1) Time Over-run:

Financial difficulties, unrealistic contract lengths imposed by customers, poorly specified project scope, client-initiated changes, either under project cost by consultants, and inadequate investigation of projects by consultants all contributed to the construction time overrun.

Contractors underestimated the project's complexity, the site was poorly managed, and the building techniques utilised by contractors were inadequate.

2) Cost Over-run:

Financial difficulties by the customer, delays in payment of finished works and alterations in designs, as well as inadequate feasibility and development techniques, poor financial management on site, and material price fluctuations were all factors that contributed to cost overruns.

Consultant mistakes in design or misrepresentation of the client's requirements are primary causes of project time and expense overruns. Typically, these flaws are discovered during construction. As a result, more time and money will be required to fix the problems. As a result, the original cost estimates may have been based on faulty designs, which may have resulted in a time and cost overrun. Thus, omissions or additional works may need further work or change orders. In addition, the consultant's tardy response and the contractor's lack of cooperation all add to the delay. The entire project duration and cost will be affected by them. Inadequately conducted investigations, design and specification flaws, plan errors, design alterations, and other factors are often to blame for design mistakes. As a result, strong communication among the design team (including the owner, consultants, and contractors) is critical to minimising design mistakes. The procurement and contractually management system is a significant contributor to project time and expense overruns.There may be disputes between the parties engaged in a project if the contract is vague and does not explicitly describe the project's scope. Contract disputes may happen if the scope of work is not fully defined, for example, if the consultants or contractors are not happy with the extra scopes that were not included in the first contract. Negotiations, arbitration, and/or mitigation works, as well as a request for a new contract with revised budgets and schedules, are inevitable when a conflict arises. Obviously, this will cause a significant amount of time and money to be wasted. In addition, a project's success hinges on the choice of contractor. The length of a project is affected by the contractor's poor planning and scheduling. The lack of expertise also impacts the capacity to make decisions, which may lead to delays and increased expenditures, such as rework. T Overruns in terms of both time and money may be caused in part by the project's inherent difficulty. Scale, stakeholder variety and change in scope are all factors in determining a project's difficulty level. Most megaprojects will have longer implementation times than smaller ones, for example. Longer construction periods increase the risk that the original budget will not be enough to execute the project on time and on schedule. Increased costs of goods and/or fluctuating currency exchange rates are all possible causes. While work is underway, alterations to the project's scope may exacerbate its already complicated nature. It will be necessary to reevaluate the project's timeline and budget, which will add time and resources to the equation. That does not even take into account the long process of integrating each stakeholder's interests and perspectives.

Further issues that might cause delays and cost overruns after construction have been completed are also to be considered. To avoid unexpected delays and additional expenditures, the handover process is sometimes dragged out owing to difficulties such as inadequate rectification works and unresolved account disagreements. Delays in paying contractors after the project is complete may also lead to disputes and delays. These issues

might cause a delay in the project team's departure and result in additional overhead costs. In order to ensure the project on track at all times, it is necessary to plan, manage, and monitor it continuously and effectively throughout its entire cycle. The project scope, objectives, critical activities, delivery time, partners, and other relevant factors must be determined and integrated into the project planning by the project manager. In order to avoid delays in the first place, it is necessary to determine what is causing them. The Project Manager has to design a control mechanism to monitor the identified problems that are causing the delay. While this is true, the success of any project is heavily dependent on the people working on it, so it is critical that the project's goals and scope be clearly defined from the outset. Only then can a strong project team be assembled, one whose primary focus is on the project's long-term success.

C) Termination of Project:

Suspension of a project signifies the project has failed, and it is the most severe scenario when all of the techniques provided fail. To put it simply, there are a number of

A lack of clarity or excessive expectations for the project's end product is a problem.

It is impossible to modify the underlying contract when requirements or specifications fundamentally alter.

Poor project management, particularly with regard to risk management

When the project's goals are met, the product or outcome is no longer required.

There are not enough people, equipment, or materials to get the job done.

Due to a high project cost or a low project income, the project is much less than projected.

The parent company has ceased to exist.

Despite the parent company's new strategic direction, the project is unable to support it. (e.g. an earthquake or flood) is considered a "force majeure."

Constraints are removed from the equation.

Lack of support from management

Customer service is lacking
To Avoid:

An organization's plan that is clearly stated.

Reasons and criteria for why and how the project supports or does not support this approach must be clearly explained.

To ensure a successful project, it is important to properly define and convey project success criteria (scope, timeline, and budget).

Management attention even for small initiatives, even if the project is on track at first.

Meetings with the board of directors on a regular basis.

Discuss issues and potential remedies or alternatives, including termination, with the control board.

a firm commitment from the board of directors and senior management to the project management team in the event that the project must be terminated, so that the team may adhere to the project closure procedures

It is necessary to devote more time and resources to certain initiatives than others. It is wiser to let rid of a lesser project if it is keeping you from dedicating the necessary resources to a more essential one. As the project draws to a close, be sure to make any final payments to vendors or partners. The buying process has also been finished. Acquire official recognition. The customer's formal approval of the project and its deliverables is obtained. An email or signed document from the client usually confirms that the research has been finished and they have accepted the project's outcomes. Finalize your performance evaluation and submit your report. When the project is complete, the results are tallied and saved for future reference. Cost, scheduling, and quality are just a few examples of how well a company performs.

In terms of whether the project was finished on time or if it could not be completed, how much was the project over budget? Records in an index and an archive The completed paperwork have been collected. Project management plans and other relevant papers are kept in a secure location for future reference. An update on what we have learnt so far All parties are involved in the process of collecting and analysing lessons learnt. The company's organisational process assets include record of lessons learned. Hands-on experience with the finished product The final result of the project is delivered to the end user for their usage after completion of the project.

1.3 OVERVEIW OF STUDY APPROACH

The Descriptive Statistical Index (RII) is used in our project to identify the important delay reasons, therefore two methodologies are used to get the desired project outcomes.

1) Questionnaire Survey
2) Event Sequencing mapping

We begin by narrowing down all of the relevant publications and research papers. Short-listed articles are investigated thoroughly by highlighting all of the most often occurring key delay reasons. Finally, the factual data of our high speed health-care construction projects, including report cards, performance reports, client-contractor discussion, Primavera schedules, and all the relevant-data, is reviewed in depth.

Once this data is gathered, a questionnaire is generated with the most common delays in review article and in fast-track building projects when combined, based on such real time data. IDAP staff members are then asked to rank the most important delays in the questionnaire on a scale from 0 to 10. The Descriptive Statistical Index (RII) among these delay reasons is then determined using this questionnaire technique.

This serves as a quick rundown of the strategy used throughout the project. The methodology section will go into depth about the study's strategy and methods.

Chapter 02

Literature Review

2.1 General:

Articles from various academic journals are being considered for inclusion in our project because of their applicability. Multi-dimensional and multi-pronged approaches are used to study them. Based on the study paper's analysis, they are investigated. In the next part, you can discover some of the results from these papers, along with their citations. Delays may be caused by a variety of factors, and we have been able to identify some of them thanks to their involvement in international building projects.

2.2 brief summary

Identifying and analysing the root reasons of construction delays, as well as making suggestions for how to avoid future recurrences, helped advance project management theory and practise in the construction sector.

AA assessment was used to determine the significance of 47 reasons for delays, in terms of survey approach. Using the relative significance index, component analysis was utilised to identify the root causes, and focus group interviews were recorded to discuss and design mitigation methods. In terms of conclusions, Six of the top ten most common reasons of construction project delays are included in this list.

Based on our factor analysis, we have identified six root causes: faulty planning, subpar consultant performance, ineffective maintenance practices, owner influence, bureaucracy, and inadequate contract terms.

Contracts should include provisions for risk management procedures to help contractors manage risks when projects are being implemented, as well as an emphasis on the most financially productive bids and award processes. Subcontractors and suppliers should be chosen with care, and site managers should be well-trained. Using data from a Portuguese case study, this study sheds light on the factors that contribute to construction project delays and the steps that may be taken to avoid them.

Luis Miguel D.F. Ferreira ((Miguel n.d.))

Construction project delays in Egypt have been thoroughly examined from the perspectives of subcontractors, consultants, and owners in this research. Seven semi-structured

interviews were done to produce a list of delay factors, which were then filtered based on Egypt's suitability. A questionnaire survey was used to corroborate the findings and identify the most significant sources of delay on the resultant list. Owner or his agent making modifications to the design during construction, not using a competent construction/contractual management firm, and delaying payment to the contractor were found to be the most significant contributing factors in the study's overall conclusion. A collaborative effort built on cooperation is needed to drastically minimise delays, according to the results of the research.
((El-Razek1, Bassioni2 and Mobarak n.d.))

Causes and relevance levels of delayed in Turkey's construction sector were investigated combined in this research. Project length was taken into consideration in 34 different ways. This was done by conducting a questionnaire survey of 71 construction enterprises in Turkey that included these parameters, and the results were analysed using statistical methods. Design and material modifications were determined to be the most prominent reason, followed by "delay in payments" and "cash flow problems," according to the data.. Financial considerations were shown to be the most important factor category, whereas environmental variables were the least effective. Time extensions can be attributed to both developed countries and developing countries, according to the research paper. Financial causes are found only in developing countries.
((Aynur Kazaz a n.d.))

In order to improve the dependability of the scheduling process, this research used the Last Planner System (LPS) as a planning and control system. Reducing the quantity of delayed tasks was made possible by the LPS's emphasis on removing obstacles. In order to reduce construction delays even more, three different construction sites were studied for this study. In all, 5424 of the planned activities were carried out, with 1450 of them being postponed. In addition to the unidentified ones, 11 additional categories of delayed activities were created and a statistical technique of means was conducted. Connecting work, changing work plans, the labour, external circumstances, material and building design are all common reasons of delays, according to the report. Aside from these more common reasons of delay, the research also found five less common ones: lack of space, equipment failure, rework, unforeseen situations, and safety concerns. In order to prevent future delays, the findings are immediately implemented to the making-ready procedure.
((Wandahl n.d.)

The study's goal was to learn more about the factors that contribute to delays in the Portuguese building and construction industry and what can be done about them. The Relative Significance Index (RII) was used to rank the relative importance of the delays caused by the 47 causes and six effects that were found. When it comes to delays, the findings suggest that weak contract specifications, unrealistic deadlines, sluggish decision-making, modifications to orders, and the kind of bidding and award procedure all to blame.

Delays and disagreements are the most significant consequences. An in-depth factor analysis uncovered eight primary reasons that lead to an additional 26 secondary causes. Analysis of Pearson Correlation Coefficients revealed that lack of high involvement and inferior products contractual arrangements are strongly linked with all consequences, and poor contractor performance is significantly correlated with time overruns. "

In the words of Luis Miguel D'Frisco Ferreira

Qualitative research was carried out by interviewing project team of long term projects in Lebanon to examine the importance of the reasons of delays in building projects. Project managers will be better equipped to cope with delays thanks to a new set of recommendations developed as a result of the study. When building projects run late, these criteria serve as a warning mechanism. The article concludes with a list of suggestions in this respect.

(Tarhini n.d.)

Using residential construction undertakings as a starting point, this research addressed a significant knowledge vacuum by identifying the many characteristics that contribute to the delay of construction projects. Relative Importance Index was used to analyse survey responses from contractors and consultants (RII). Contractors and consultants listed delays in projects in India as a result of material shortages; unanticipated soil types; poor procurement planning; difficulties accessing the site; rework; wind patterns; insufficient modern equipment; skilled staff; and equipment breakdown. It is advised that construction front-line players focus their energy on the identified main elements in respect to their degree of effect.
((Subhav Singh n.d.)

It was the goal of this study to look at the attitudes of the project's clients, designers, and contractors toward completing the project on time, as well as to identify the primary reasons of construction delays and provide recommendations for how to reduce them.

Survey objectives included determining the role of management in minimising the impact of delays; identifying the types of and ended up causing of delays in construction; and receive feedback on methodologies used to resolve or mitigate the impact of delay incidents. Specifically, this survey sought to determine:

The surveys were sent to 502 firms in the Klang Valley Selangor Area states, including customers, consultants, and contractors.

For this project, we spoke with two clients, ten contractors and four consultants about the three parties involved. According to the questionnaire and interviews, existing construction management practises are being analysed as a basis for comparison.
((Berawi2, et al. n.d.))

Construction project delays may be attributed to a wide range of factors, and this research focused on housing building projects as one example. Relative Importance Index was used to evaluate the responses to a survey given to contractors and consultants (RII). Lack of materials on site, unrealistic project scheduling and delays in the supply of materials; labour absenteeism and delays in payment by the owner for completed work were ranked by contractors and consultants in Cambodia as the main causes of construction delays, according to a survey of more than 1,000 construction professionals. Key issues in the construction industry should be prioritised based on their size of effect. This might considerably decrease or regulate the factors that contribute to growing construction project delays in Cambodia.
((Serdar Durdyev n.d.))

Chapter 03

Methodology

3.1 Introduction

Analysis of the delay drivers and verification of findings through the use of experts in the field are the goals of this study, which combines elements of case studies (MCS) and questionnaire surveys. Methodologically, MCS allows for an in-depth exploratory research of phenomena that are not clearly defined (Yin 1994). Finding the link between real-life intervention studies that are too complicated to be revisited through other research methods is the key benefit of case studies (the case study doctrine is used through linking PSP safety procedures, for illustration, in Chen (2009), Guo et al. (2011) and (al n.d.). (2018).

The beginning of this chapter describes the process that data was collected leading up to this study. The sampling strategy and the method of data collection are likewise examined. The data analysis procedures and methods that constrain accuracy and interpretation are also discussed. Ultimately, the framework for the study is explained.

The study examines the contemporary phenomena in a large range of fields, such as such as data analysis, data gathering, and outcomes. This research is devoted to describing authentic as opposed to developed normal routine choices. This methodology is an excellent technique for analyzing and tracing the delay factors that greatly affect the procedures associated with construction projects.

This chapter incorporates all factors that influence an extensive construction project's workflow. The primary factor to consider in our investigation was identifying the variables leading to a project's delay leading to EOT and in extreme cases Termination of project. It also identify the gravity of delay incurred in various projects that we were analyzing.

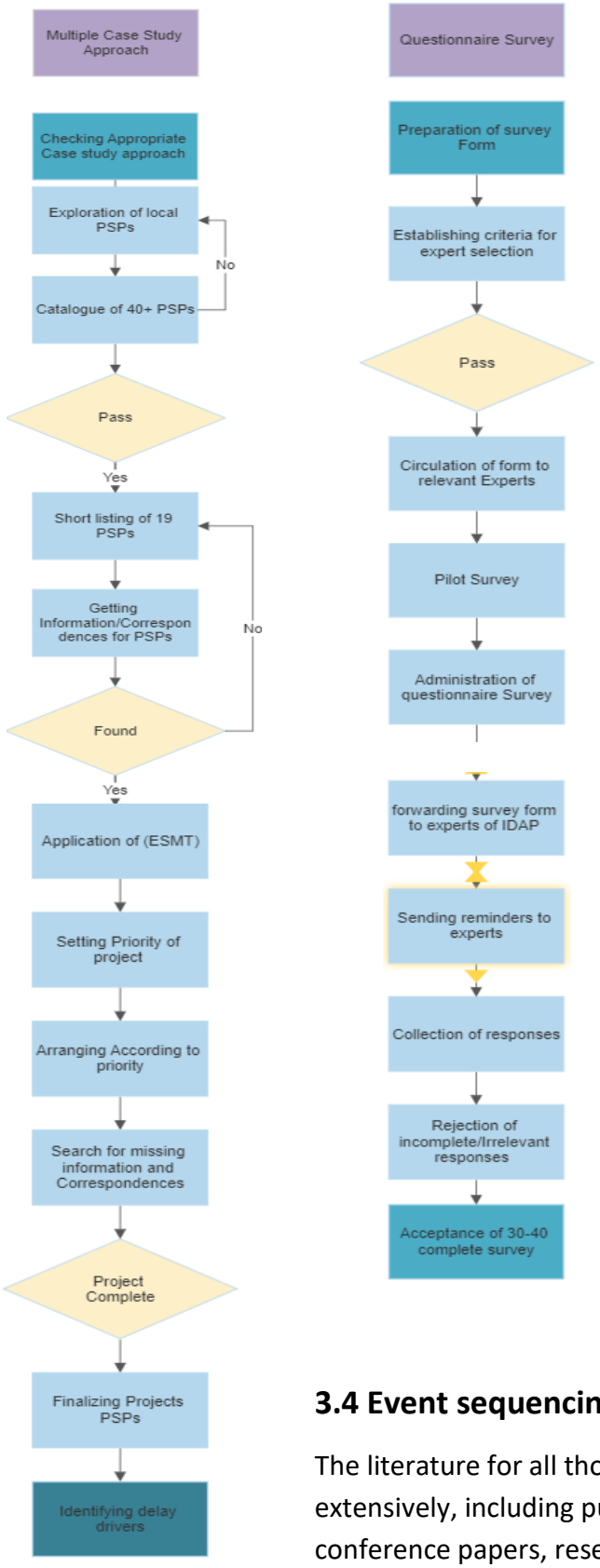
A diagram depicting this paper's overall research process is shown in the figure, showing the entire process from the collecting data from delayed projects to the firm conclusions from this study.. Methodology: Phase 1: Multiple Research Report Attitude; Phase 2: Survey Research; Phase 3: Big Data but instead Report Writing; Phase 4: Conclusions (Phase 04).

3.2 Selection of Delayed PSPS

The Punjab Infrastructure Development Authority provided the data for the delayed PSP (IDAP). PSP projects running the gamut from redecoration to the construction of THQ and DHQs can be found in the database. Building-operate-transfer and brownfield projects (e.g. rehabilitating-operating-transfer) were the models for these PSPs These projects were carried out in various parts of the Punjab province. Database records show that a final count of 19 PSP installations were overdue, with some of those delays reaching 1200 days. It did not matter that the project was supposed to last 150 days.

3.3 Shortlisting of Delayed PSPs

After that, we had to figure out who of the 40 works had been delayed. Project success/delay is even more difficult to define from the perspective of the various stakeholders involved, making it even more difficult. The PSP's success or failure is a subjective matter, and every party may use a different set of metrics to determine whether or not it has been a success. PSP are, however, expected to produce value in terms of economic growth, efficiency, and relevance, and a PSP that fails to deliver value can be rated as a failure in relative to traditional public sector procurement. (Part 1 - Research Results about the PSP | Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects |The National Academies Press). "The failure of the public-private partnership to deliver its eagerly awaited value due to the negligence/poor playing ability of either or both partners" ((Tariq 2020)) is what we mean when we talk about a failure in this study.



3.4 Event sequencing mapping

The literature for all those shortlisted diverse PSP was examined extensively, including published books, journals, newspaper articles, conference papers, research reports from non-profit Donation agencies, academic papers, working papers, and case studies can all be found in the dbms and other physical online platforms.

When a project's details and information were not contained in a single document, it was more common for multiple documents to be found. This led to a problem of determining which document to trust in the event of a discrepancy in the timing of each event, and putting together all the major and nanosecond details.

Hossain and Zhang (2013) used the ESM technique to address this issue in their study. To begin, an absolute order was assigned to the documents for the purposes of correlating any possible discrepancies. There were three types of publications mentioned first: academic publications (such as books, journal articles, journal articles, and policy papers), government reports, and financial reports (such as e-books and website articles). However, reports from nongovernmental organisations and articles on websites were given higher priority than articles in newspapers and working papers published online. Events that were not detrimental to the PPP were first arranged in terms of its relative timings, and then those events were ruled out.

Third, IDAP was used to gather missing information relationships and put them on a priority list. Fourth, projects that failed to reveal the complete delay sort of situation were excluded from the final selection after having to navigate the loop from inaccurate details to list to multiple times finding information. In the end, 19 projects with delays were selected, each with a range of possible causes for the delays.

PROJECT DATA							
SERIAL	PROJECT TITLE	BUDGET	TYPE	PROJECT ID	DURATION	DELAY	GRAVITY OF DELAY
1	PACKAGE 5A	111,057,320	DHQ	Project-5A01	06/07/17-02/07/18	201	LOW
2		158,253,873	DHQ	Project-5A02	20/07/17-12/12/18	360	MEDIUM
3		160,388,794	THQ	Project-5A03	05/07/17-29/01/19	423	MEDIUM
4		330,260,186	THQ	Project-5A04	09/06/17-19/10/18	347	MEDIUM
5		4,269,633	THQ	Project-5A05	19/07/17-13/12/18	362	MEDIUM
6		179,493,784	THQ	Project-5A06	21/06/17-24/01/19	432	MEDIUM
7	PACKAGE 5B	136,012,666	DHQ	Project-5B01	10/07/17-15/08/18	251	MEDIUM
8		295,135,536	THQ	Project-5B02	14/06/17-15/03/21	1220	HIGH
9		137,374,267	DHQ	Project-5B03	09/06/17-04/07/18	240	LOW
10		4,572,522	THQ	Project-5B04	09/06/17-02/03/18	215	LOW
11		297,947,596	THQ	Project-5B05	15/07/17-12/04/18	309	MEDIUM
12	PACKAGE 3A	4,335,617	DHQ	Project-3A01	25/07/17-15/04/21	114	LOW
13		185,192,527	THQ	Project-3A02	16/08/17-04/07/20	903	HIGH
14		90,325,235	THQ	Project-3A03	09/07/17-02/03/18	86	LOW
15		285,278,752	THQ	Project-3A04	15/11/17-12/04/19	363	MEDIUM
16	PACKAGE 3B	130,066,624	DHQ	Project-3B01	25/09/17-02/08/18	161	LOW
17		285,258,681	THQ	Project-3B02	20/11/17-16/12/20	972	HIGH
18		117,495,719	THQ	Project-3B03	05/12/17-29/01/19	270	MEDIUM
19		4,513,776	THQ	Project-3B04	09/09/17-19/10/20	986	HIGH

Definition of Delay

Assaf and Al-Hejji (2006) defined construction delay as "the time overrun either further than implementation prescribed date in a contract, or outside the dating website that the countries consent upon for the delivery of a project. " As defined by Zack 2003, a delay is also a "act or incident which spreads considered necessary time to operate or perform assignments of the service agreement manifests itself as supplementary days of work."

International Studies

In a variety of articles, the causes of construction project delays have been discussed in various ways; some reports have identified the primary causes of delay in a variety of countries and building projects types, while other accounts have addressed delay research approaches and policy recommendations to mitigate delay. There were six studies that compiled a list of delays. In 1971, Baldwin et al. conducted a study to find out why construction projects in the U.s.a. were taking longer than expected.

In 1992, Mansfield et al. examined the factors of delays and cost overruns on finalised highway projects in Nigeria, and their findings were published in the Journal of Transportation Research. Large-scale construction projects in Saudi Arabia were studied by Assaf and colleagues in 1995 to identify the most common causes of delays. A randomised sample of builders, consultants, and business owners participated in the survey. Noulmanee et al. used the Nontaburi avoid road project as a case study. (2000) talked about Thai highway construction project delays and the internal factors that contributed to them. Building construction delays in Florida were studied by Ahmed and colleagues in 2003., each cause was then assigned its share of duties and delays were assigned to them. A study by Husain and Phatak (2004) looked at the factors that contribute to the overrun of construction projects in the commercial sector.

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The findings of previous research were used to compile a list of the most common causes of delays. Ahmed et al. 1995 had the most delays (56 causes), and it was also located in Egypt, so that is a plus. Consequently, the did cause listed in the Think and believe et al. 1995 research aimed as data, while other causes were compared.

Assaf (n.d.)) also classified the nine major sources of delay as follows: funding, materials, contractual relationships; changes; government relations; manpower; scheduling and control; equipment; as well as the physical environment and the state of equipment. For the sake of a more comprehensive view of the delays that have been documented in other studies, authors opted to be using the same seven groups while adjusting the "government relations" description to "rules and regulations.".

3.5 Identification of Delay Drivers

In the Public Sector, there are a lot of possible explanations for the delays that have occurred. It is therefore necessary to concentrate on investigating and implementing measures to reduce or manage delays in the construction process.

Descriptive statistics and inferential statistics are used to collect and verify these identification and examination procedures, which are then verified statistically. The most significant determinants of project duration were isolated based on the findings of the Ranking of Causes. There are 21 factors that contribute to PSP delays, and in order to determine the validity, they are evaluated by comparing to the results of relevant studies published in other countries.

Revamping and building new DHQs and THQs in sindh Province is being hampered by a number of significant factors. To put it simply, delays are caused by factors such as unrealistic project schedules, labour absenteeism, adhering to safety protocols on the construction site, design changes, shortage of skilled labour, smog, political instability, and various construction errors.

The second most common cause of problems is a latency in the Government Business project. Unrealistic expectations about the productivity of the workforce, as well as delays caused by the building's construction, can lead to unrealistic scheduling and delay the project. Employees who are put under unreasonable demands for their work output, such as those who are required to work long hours, can become physically exhausted and lose their motivation as a result. Research in various countries has found that the most significant main causes delays (Frimpong but instead Ren 2008) are in agreement with this result.

PSP project delays are most often caused by a lack of qualified workers, according to the Research centre for Supply Management. Despite the use of cutting-edge technology, the construction industry remains a labor-intensive industry in which labour skill is unquestionably the most important factor in a project's success. The success of a construction project will undoubtedly be enhanced if the quality of the labour is improved. Most In rural areas, most construction workers are unskilled or inexperienced. On the other hand, the vast majority of qualified construction workers (engineers, consultants, quantity surveyors) native to South Korea, China, Singapore, and Thailand, respectively. Shortages in the construction projects are caused by an inability to fill positions with locals because of the reliance on short-term workers from other countries.

Delays due to labour absenteeism ranked third in the South Punjab DHQ and THQ renovation project. The apparent lack of the employment will lead to delay in on-site tasks and a lower level of productivity, which will have a negative impact on the project's total duration as a result. As a result of the following factors: socio-cultural life style; cheaper labour profile working in the construction works; living much away from the village; lack of labour commitment toward a project; and weather conditions, labour absenteeism occurs frequently (particularly during the rainy season)

Losing money by changing specifications is a major factor in the many design changes that occur during construction projects. Disputes and long delays are common as a result of this. In the words of Mahamid, Bruland, & Dmaidi (2012). During the course of any construction project, it is possible that design changes will need to be made for a variety of reasons. Designers have identified three main reasons for design change: an extra task from the client (Austin 2002), a lack of communication between the parties, and the salary package (Love, (Holt 2002)).

Questionnaire Survey

Individuality, location, and word choice are all factors that contribute to the success of a questionnaire when it comes to obtaining responses and then analysing them.

- Introduction: To lay out the goals in a clear manner
- Instructions: In order to make the questionnaire clear,
- User-friendly: For the sake of clarity,

As a final step, a Likert-scaled survey form is used to rate each contractor factor in concepts of delay effects mostly on life of the project, with 1 (not significant) and 5 (the most frequently occurring factor at the site) being the most common (extremely significant).

1. It is not important.
2. It is only a minor factor.
3. Significant.
4. It is a big deal.
5. It is a big deal.

Neither a measurement theory nor a scale can be used to determine the value attributed to a Likert item; instead, researchers who design surveys must decide on an ideal level of detail before assigning a value to each Likert item. Good Likert scales present categories in symmetrical fashion with well-delineated linguistic qualifiers at their midpoint ((Caletka 2008).

Analysis of Survey Responses

Relative Importance Index Technique

When determining the relative importance delay factors, Kometa et al. used the Descriptive Analysis method Contractors and developers use the Multiple Criteria (RII) to rank the factors that contribute to project delays. Dadzie (n.d.) states that the Index Index is calculated as follows:

$$\mathbf{RII = \Sigma^{5}_{r=1}\ r*n_r\ /\ (A*N)}$$

How much of an impact does one specific factor have on construction delays on a Point likert - type scale (1-5)? Nr is the group of participants who gave a specific Linkert rating for that factor. N is the total number of people who answered a particular question (Naoum, 1998).

Using these rankings, it is possible to see which factors contributed most to the delay. This survey includes 21 different factors that fall into various categories. Experts from the Infrastructural Authority of the Haryana (IDAP) were consulted on the questionnaire (IDAP).

31 people responded to the survey. Responses, on the other hand, have proven to be dependable and genuine. As a result, data from 31 respondents was analysed, and the Relative Importance Index was calculated using the formula provided above. The factors' RIIs are mentioned in table elsewhere here, with the strongest RII at the top (highly significant) or the highest RII at the bottom (last rank) (not significant):

And according to messages collected, unrealistic construction management one of the most valuable factors that cause delays, as evidenced by its rank-1. Poor site management is the only factor that contributed to the delays. It could be because the site manager lacks the necessary expertise. Respondents ranked "Site Acquisition" as the second most problematic aspect of the site. The acquisition of the site was motivated by the fact that it was in use during the pandemic. This contributed to the delay of construction projects..

Mean Score Ranking

Delay operators are ranked using the Chan and Kumaraswamy mean score ranking method (1997). The following equation can be used to calculate the M:S, or mean to standard deviation, of a test.

$$M.S_i = \Sigma (F_i XR_i) / N$$

Ri = the score for the ith diver; When asked about the ith Delay driver's performance, participants were asked to rate it on a scale of 1–5, with 1 being the least significant, 2 being marginally significant, 3 being significant, 4 being very significant, and 5 being extremely significant.,

Table 1.0 Rank of all causes of project delays

Causes of delays	RII	Rank
Unrealistic Project Scheduling	.90	1
Access to Site	.893	2
Adherence of safety protocols on site	.82	3
Labor Absenteeism on delays	.8	4
Design changes	.74	5
Shortage of skilled labor	.7266	6
Political instability	.72	7
Rework due to various Construction Errors	.72	8
Site Acquisition	.6866	9
Project Delivery Method	.68	10
Poor site management	.68	11
Accidents occurred on site	.6533	12
Weather conditions	.6533	13
Unavailability of material	.6333	14
Complexity of Project	.6266	15

Poor communication	.6133	16
Poor labor Productivity	.5866	17
Inconsistency between financial and technical program	.5866	18
Price Fluctuations/Inflation	.5666	19
Complex of project	.5333	20
Lack of high-tech Equipment	.52	21

Table 2.0 Rank of all causes of project delays

Causes of delays	Max	Mean
Unrealistic Project Scheduling	19	4.5
Access to Site	18	4.4
Adherence of safety protocols on site	17	4.1
Labor Absenteeism on delays	13	4.0
Design changes	14	3.7
Shortage of skilled labor	11	3.63
Political instability	13	3.6
Rework due to various Construction Errors	13	3.6
Site Acquisition	15	3.43
Project Delivery Method	13	3.4
Poor site management	10	3.4
Accidents occurred on site	9	3.266
Weather conditions	9	3.266
Unavailability of material	10	3.166
Complexity of Project	12	3.133
Poor communication	10	3.066
Poor labor Productivity	9	2.933
Inconsistency between financial and technical program	11	2.933
Price Fluctuations/Inflation	10	2.833
Complex of project	10	2.663
Lack of high-tech Equipment	9	2.6

Chapter 04

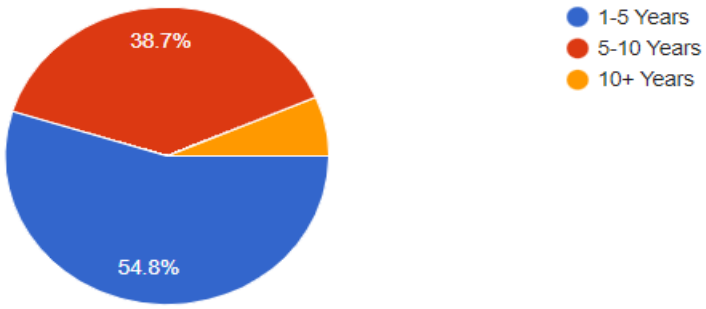
Results and Analysis

4.1. Survey results

The survey form was circulated among experts of Infrastructure Development Authority of the Punjab (IDAP). The survey was extended to 45 respondents. But out of all those 45 responses, only 31 responses were useable; this represented approximately 64% usable response rate, which is perceived as adequate for analysis and reporting the findings of this research (Miller, 1991). In the questionnaire survey method, background of the respondents signifies the data reliability.

4.2 Relevant experience

Thus, detailed analysis of the demographic profiles of the respondent's shows (i.e. 9%) occupied high-ranking positions as project manager, General Manager, Site Manager with approximately 10 years of work experience in the construction industry. The highly experienced profile of the respondents added to the quality of the feedback and the findings of the study.



Relevant experience

Moreover, the majority of the respondents were having field experience of 1-5 years in construction industry with percentage of (54.8%) and the responses of professionals with 5-10 years of relevant experience was (38.7%) contributing to a total of responses received.

4.3 Parties responsible for delay

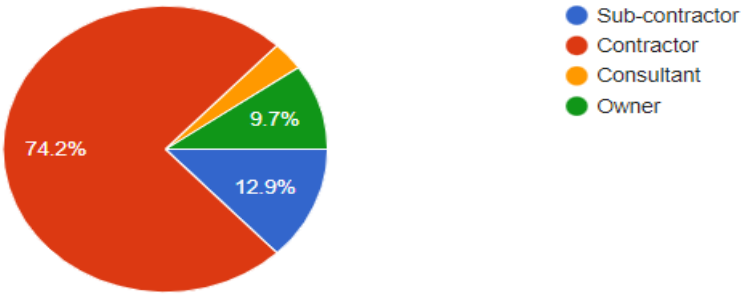
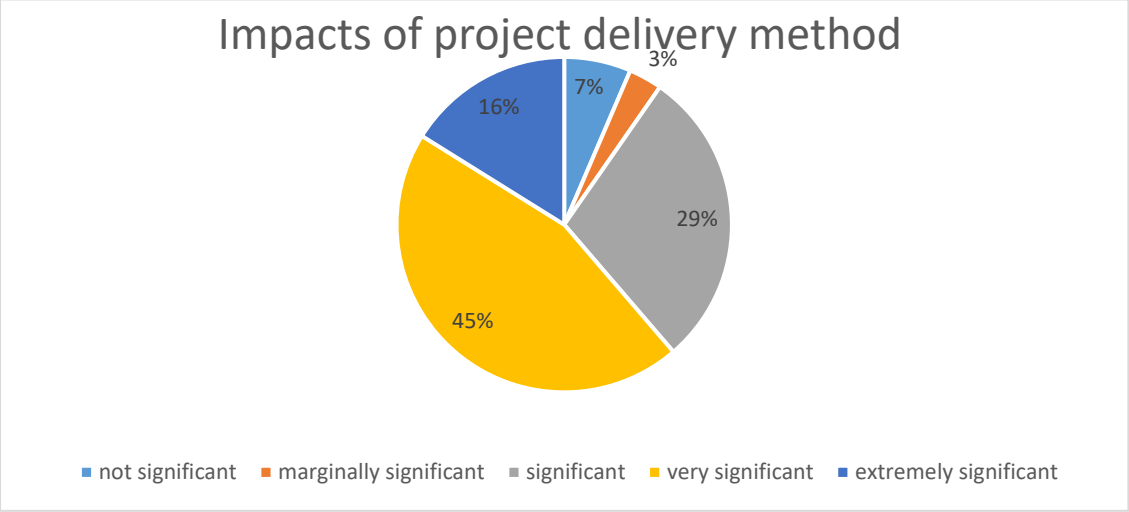


Figure 4.2 Parties responsible for delay

By analyzing figure 4.2 it can be extracted which party was involved in causing the delay in the whole construction/revamping process, the responses show the major delay was caused form contractors side, contributing to a major percentage of (74.2%) of the total responses received. The least responses received form survey was for the consultant contributing with percentage of responses of (4%).

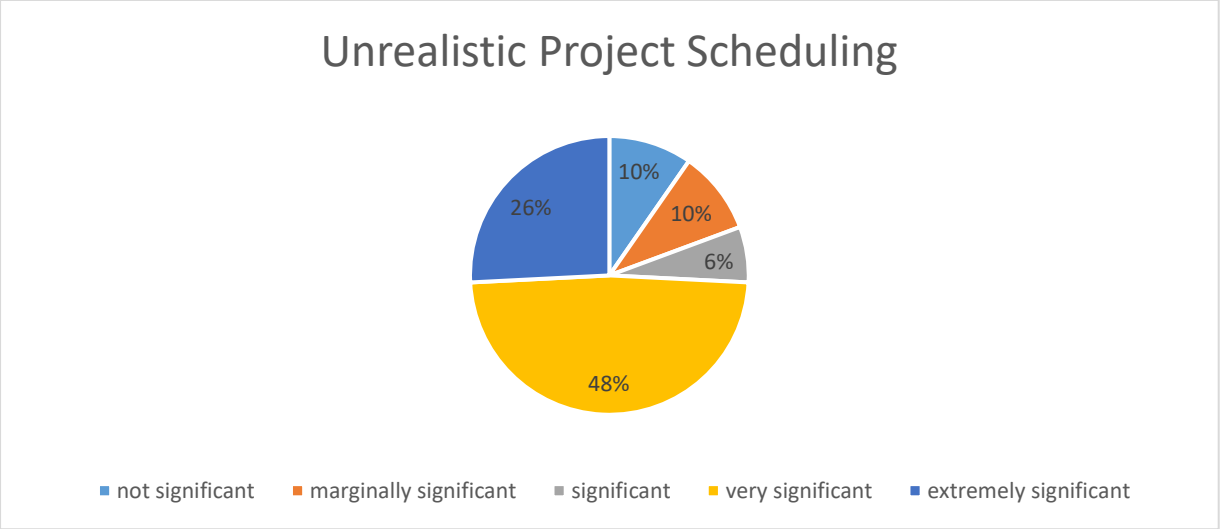
4.4 Delay drivers

Impacts of Project delivery method



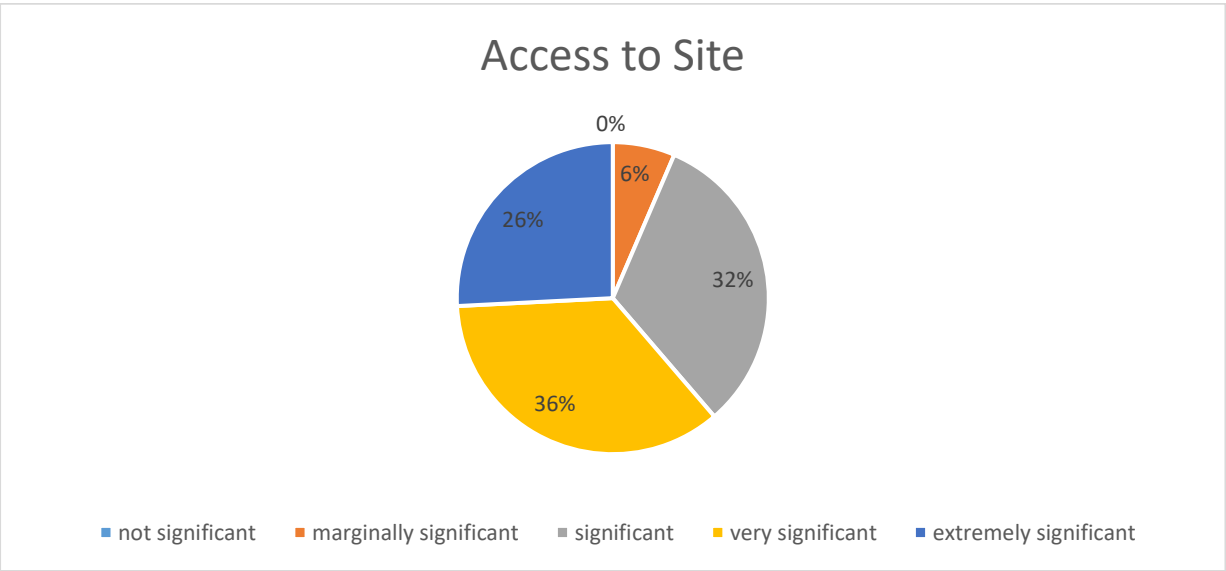
The most suitable project delivery method reduces the risk of meeting goals and improves chances of attaining project goals, cost, and deadline. It also provides for additional management control over specific aspects of the project. Whatever choice you make, it's important to be certain of the different options available to you. From the responses received the majority of the responses were in favor that the project delivery method contributed to a major percentage of **45.2%.** Impacting the overall life cycle of project.

Unrealistic Project Scheduling



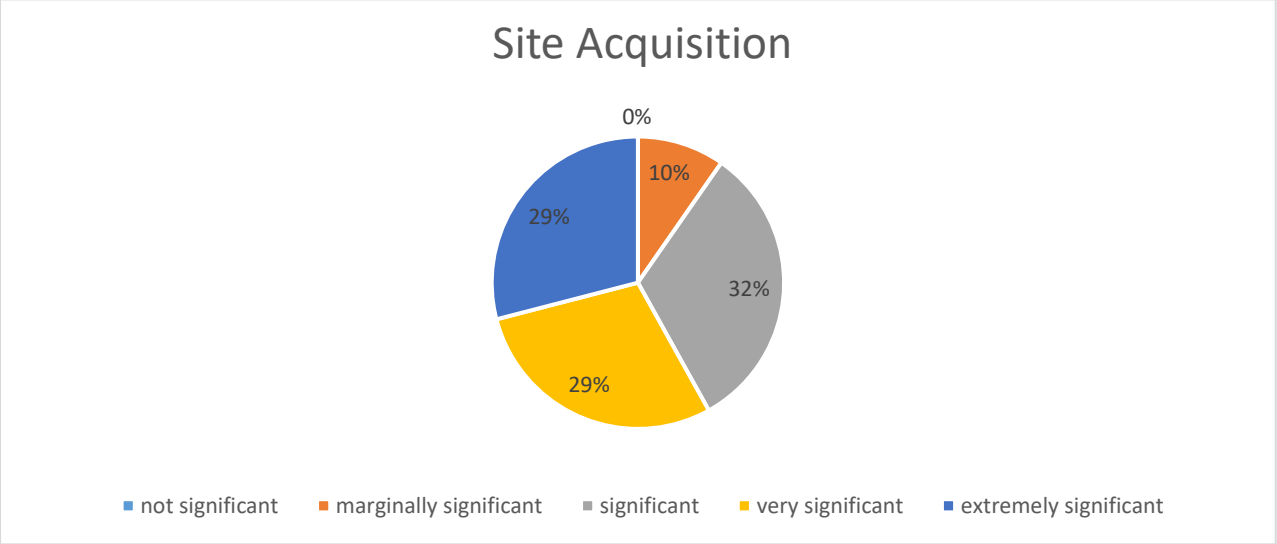
Realistic scheduling is only possible if the project manager is using the project management tools correctly. Which will impact the overall life cyle of project causing delay in whole construction process. If the Scheduling is not done properly. From the responses received form the experts. The majority of the responses were in favor of that the Unrealistic Project Scheduling impacts with and 49% of the respondents agreed that it is very significant delay factor.

Access to Site



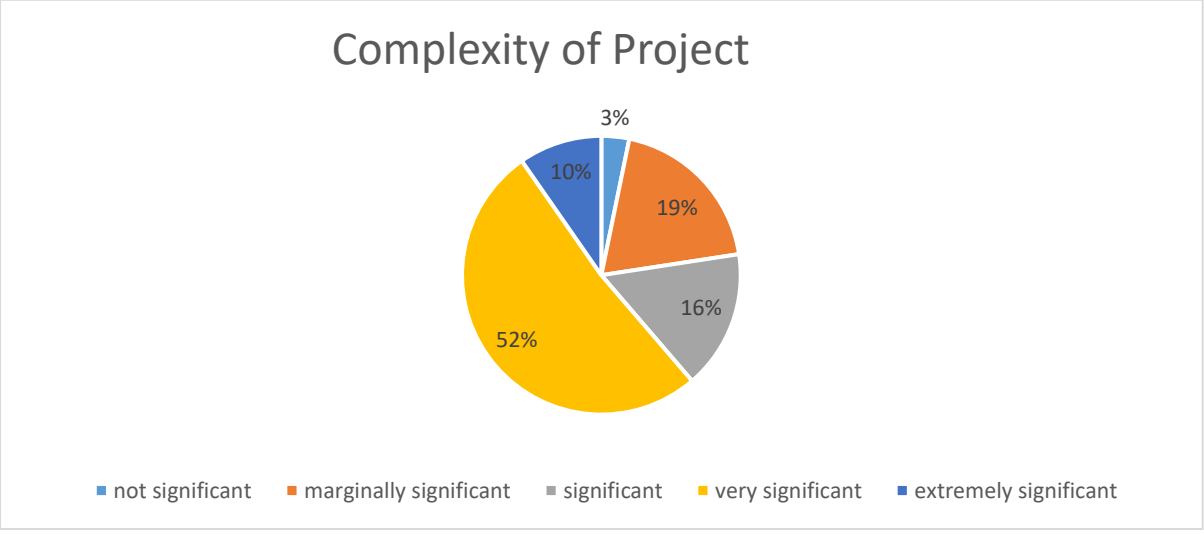
Access to site is important as it means reaching the location from adjoining parcels or internal access from one part to another part of the site for pedestrian or vehicular traffic, on the condition that other routes of access are not available or impractical. The overall responses received shows that the experts agreed that this factor contributing to the delay of the construction project will impact the construction process **significantly** with percentage of responses contributing to **35.55%** of the responses.

Site Acquisition



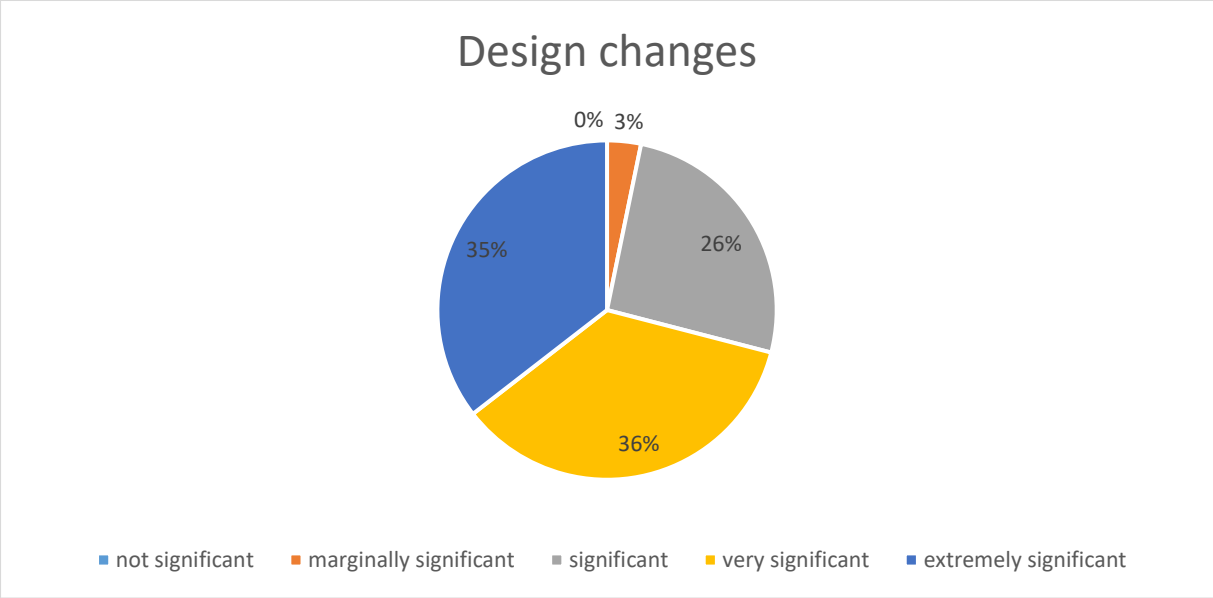
Among other delay drivers, the major contributor to the overall delay of the project was the site acquisition. As site was not available for construction. As it was already in use Due to ongoing COVID-19 Pandemic. So, the site including various DHQ's and THQ's were under usage. Which caused the delay in project leading to delay in some projects upto 1200 days. The responses received form the experts also showed that this facts contribute to high significance leading to the delay of project with maximum responses form experts in favor of extremely significance Delay driver.

Complexity of Project



Complexity can influence project planning and the subsequent control of that project. It can make it difficult to identify goals and overall objectives, it may negatively affect the choice of a suitable project organization form, and it can impact project outcomes. So, this delay driver also have a importance and need to be considered in overall construction project. The responses received form the experts also shows that this particular response with maximum responses of 16 experts in favor that this factors contributes and is **Highly significant** delay driver with total percentage of **52%.**

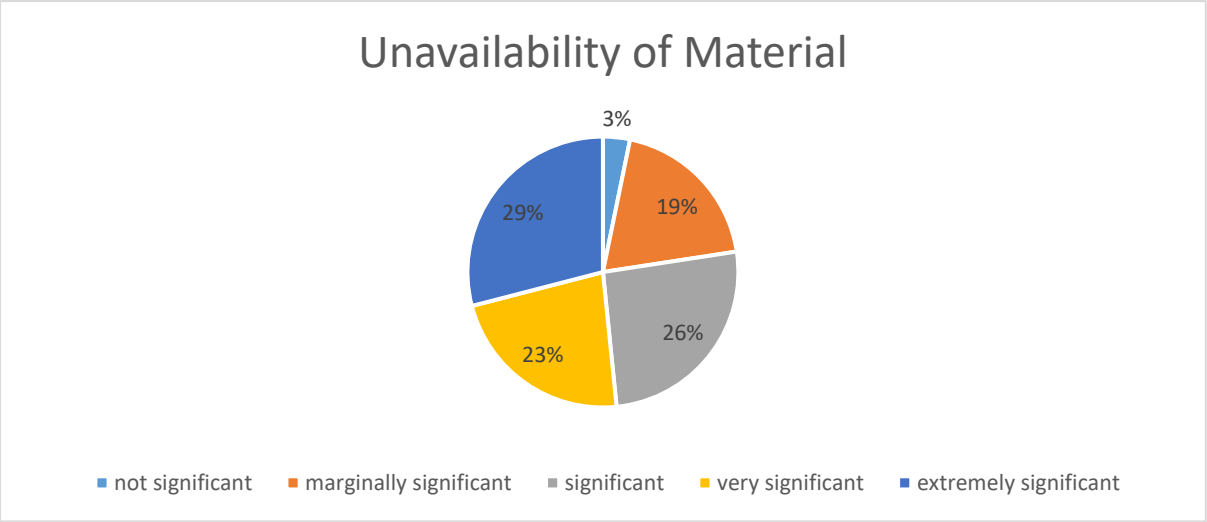
Design changes



Changes during the course of the constructional process are always inevitable and cannot be avoided. The design change is the biggest contributor to the disruption caused by construction activities. The accurate information on earlier studies is lacking on this subject. This delay facts majorly leads to EOT, Claim order form contractor's side. Which will impact the overall life cycle of project and leads to delay in construction process.

The response form experts of IDAP have given this particular delay driver an importance of bing a significant and a Extremely significant factor as well. As the response received for this particular was a tie between both two with equal responses of **36%** in favor of both.

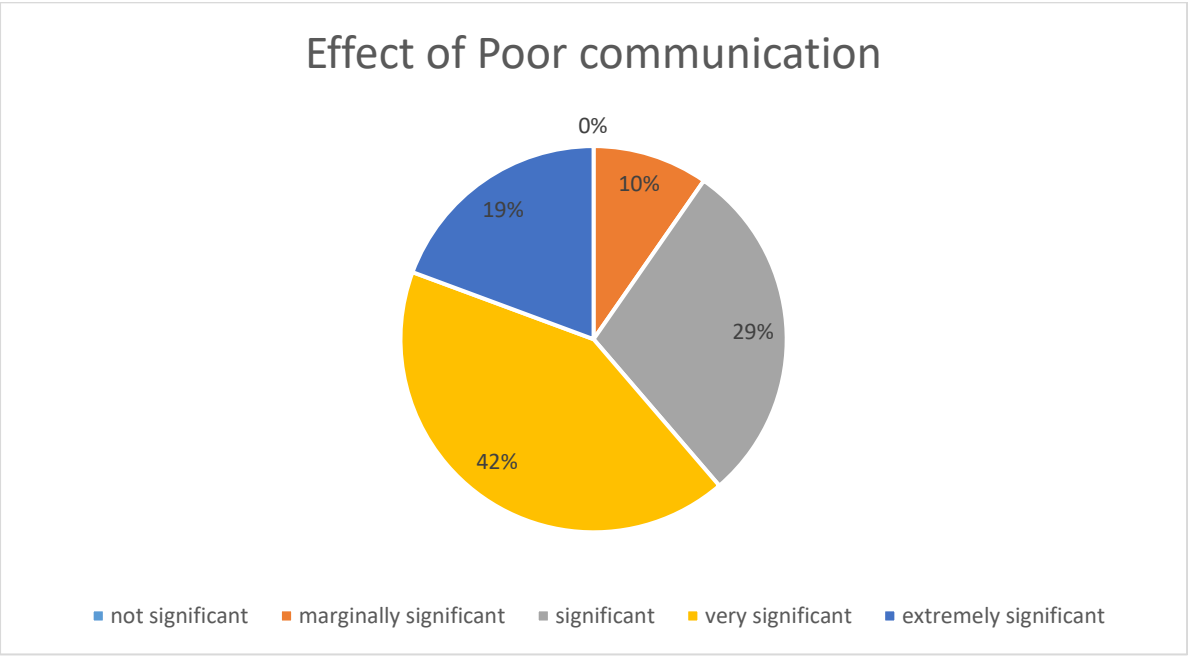
Unavailability of Material



The building material affects the visual characteristics of the structure, as it deals with how the structure's appearance is affected. The construction materials also influence the durability of the structure. As a result, the character of architecture is dependent on the relationship between the build qualities of the building materials.

The responses shows that this factor impacts the construction process as experts agree that this delay driver contributes to **30%** with maximum responses of 9 experts in favor of this. Which will cause the delay in overall construction of project.

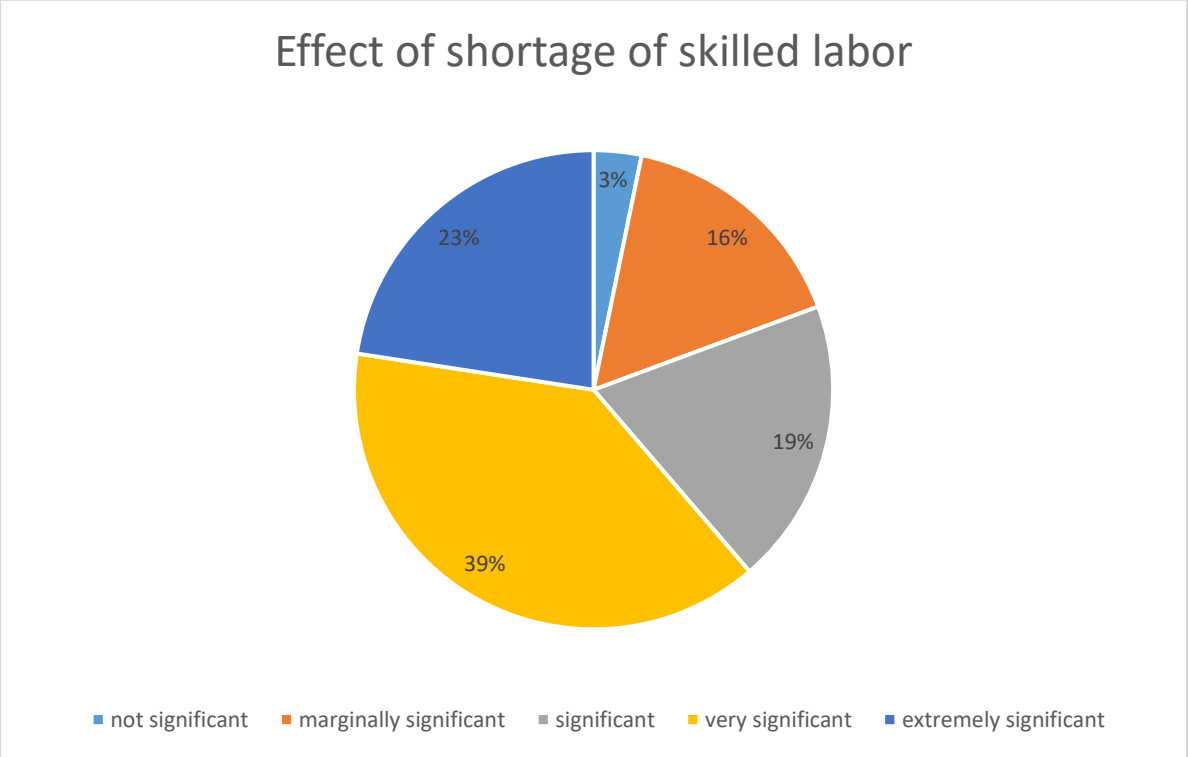
Poor communication



Effective communication is among the most essential aspects of any construction project's completion. Good communication is important to improve teamwork and enhance project collaboration. Poor communication often leads to limitations in understanding and completion.

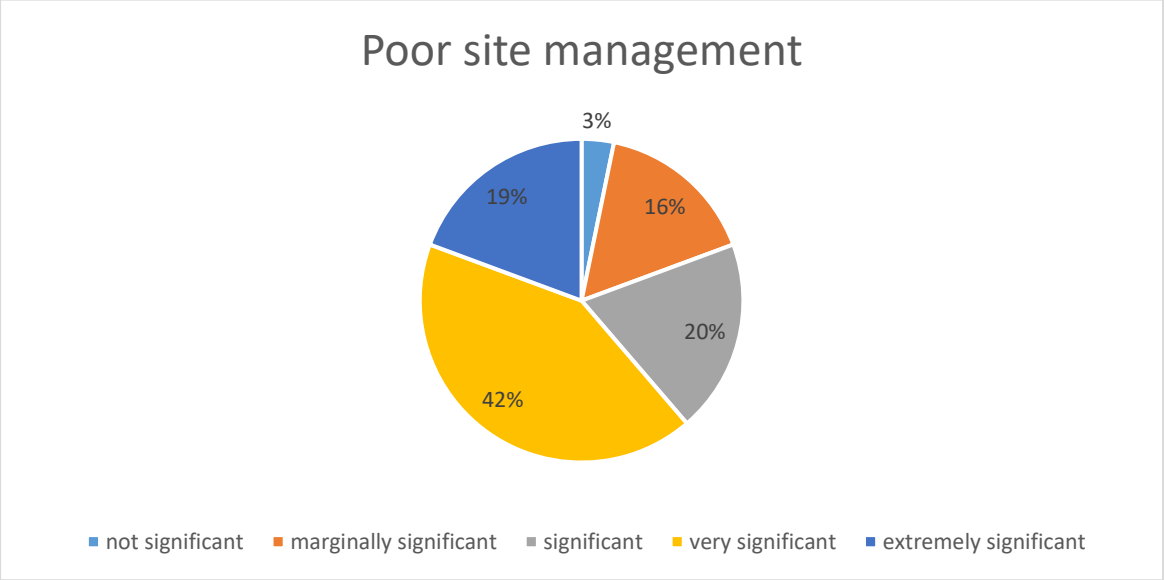
This factor is important as poor communication between various stakes holders can lead to change orders which will cause a long delay in project. With maximum experts in favor that the this particular delay will cause a highly significant delay in the whole project. With maximum responses of 14 experts agreeing to this leading to a percentage of 42% of overall responses.

shortage of skilled labor



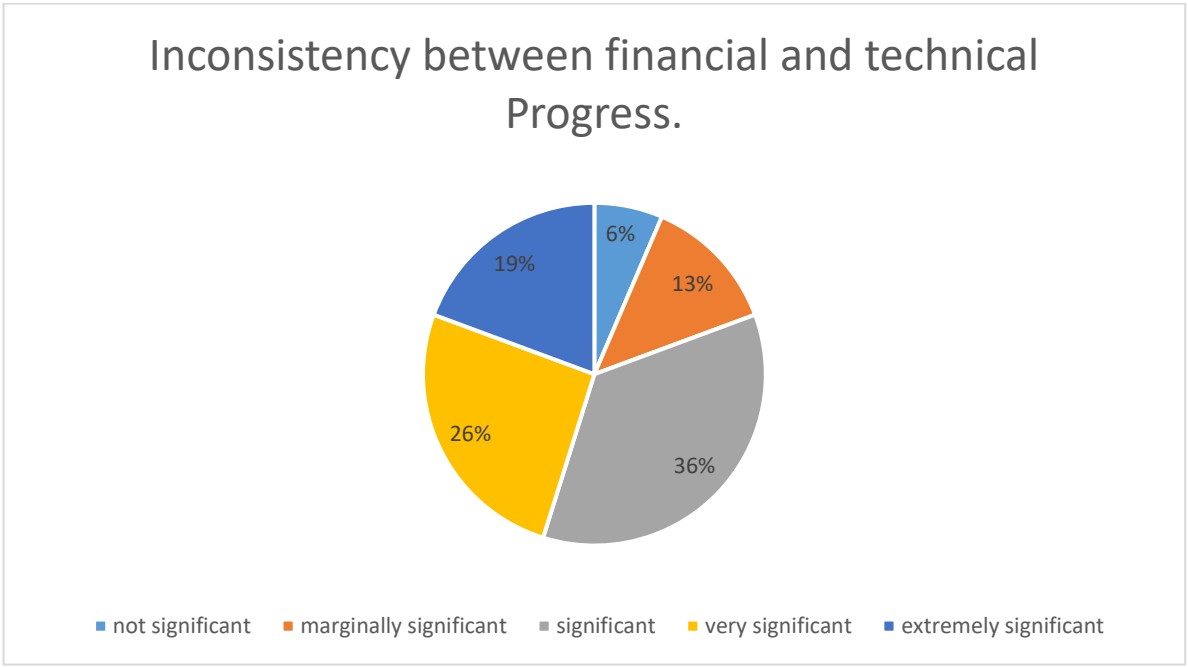
Lack of available workers is among the most significant schedule challenges associated with projects (Balayi, 2011) that may influence project viability and may produce excessive costs and overruns. The responses received form the experts of IDAP shows that this particular delay driver will lead to be a very significant delay driver with maximum responses of 13 experts in favor of it and percentage of responses of **39%** responses contributing to this delay driver.

Poor site management



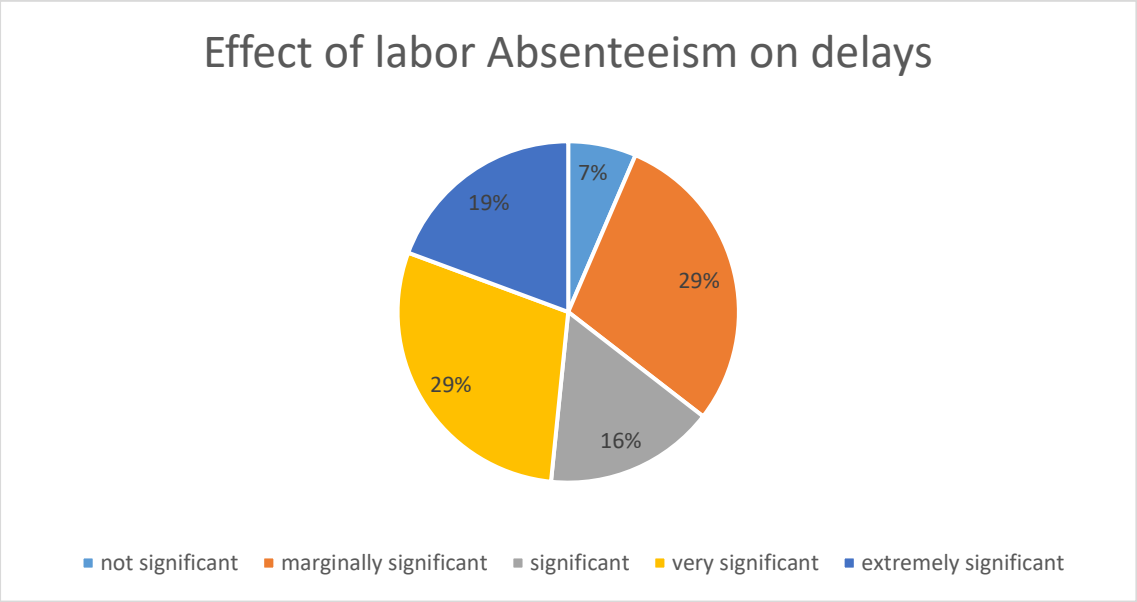
The success of a construction project ultimately depends on effective construction work management. All construction projects are unique, so they may have different requirements, schedules, pressures, and concerns. However, each project functions within a system of construction and the production itself relies on the project's completion. Responses showing it to be a **very significant** factor leading to the delay of construction project with maximum responses in favor of poor site management leads to delays in construction project contributing to overall delay form response are **42%.**

Inconsistency between financial and technical Progress.



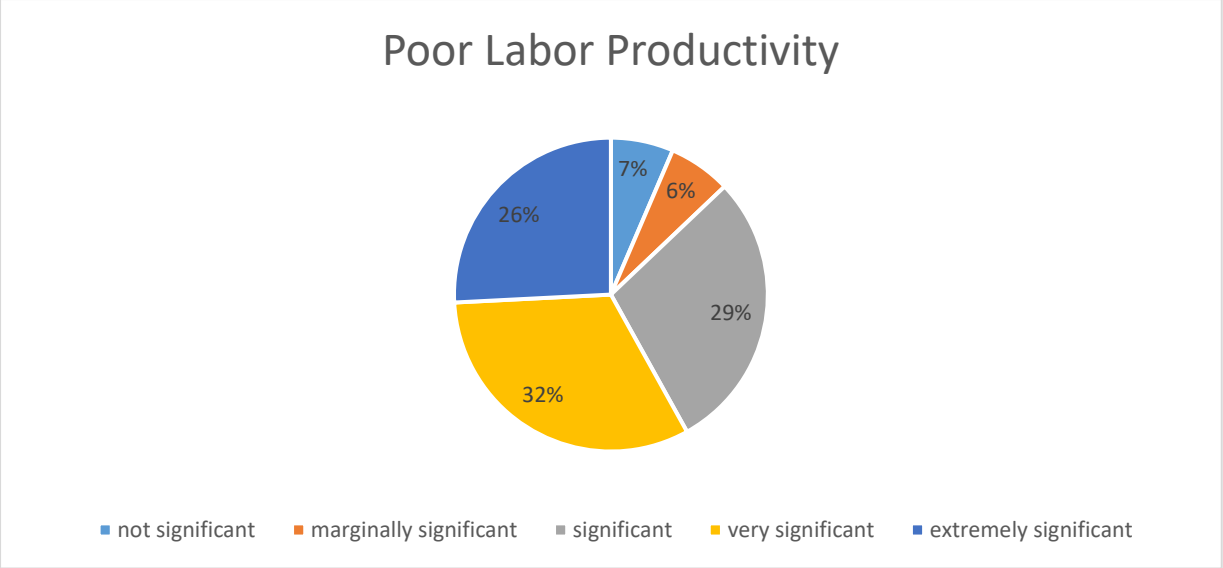
Among other delay driver that impacts the overall construction project. The inconsistency between the financial and technical progress of a contractor will also lead to the delay in the construction project. That's the reason these things re accessed during bidding phase. So, any non-responsive bidder is neglected during bidding phase. The responses of the experts tells us that this delay driver will lead to a significant factor with total percentage of **36%**.

labor Absenteeism on delays



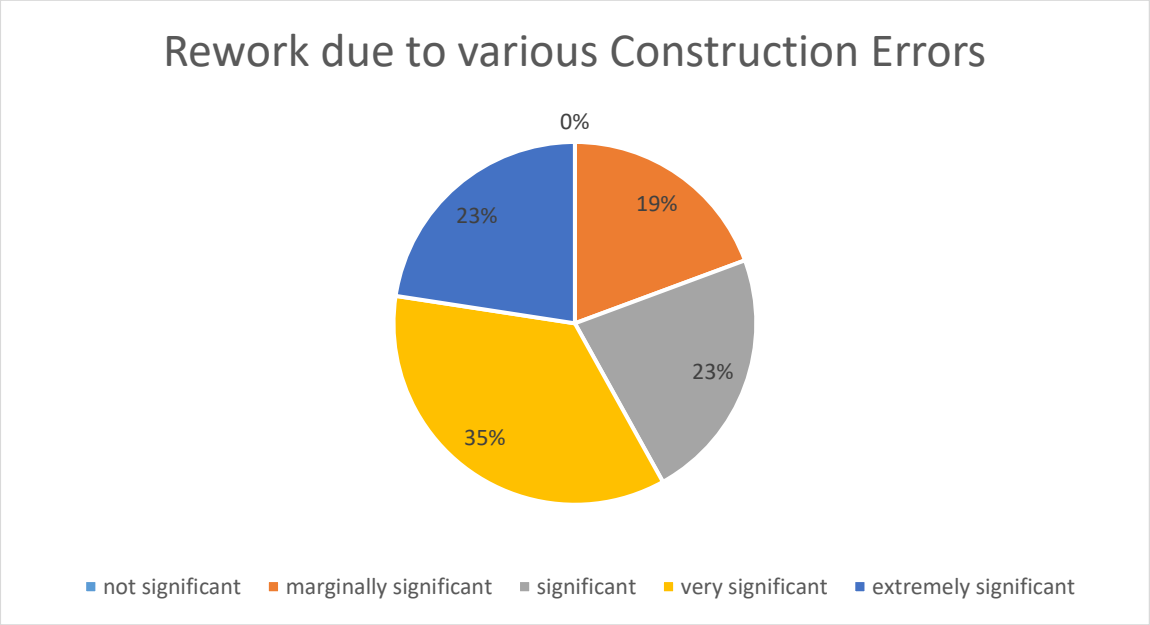
Labor is an essential resource in construction. The productivity of the whole construction project will decrease, and task accomplishment may be delayed. If the required man power is not available at the construction site. The responses form the experts shows that this particular delay will lead to overall delay in construction project if not catered. As it leads to be a significant factor to overall delay in construction of a project. With percentage of response equal for both experts saying it to be a very significant as well. With percentage of responses to be **30%** for each.

Labor Productivity



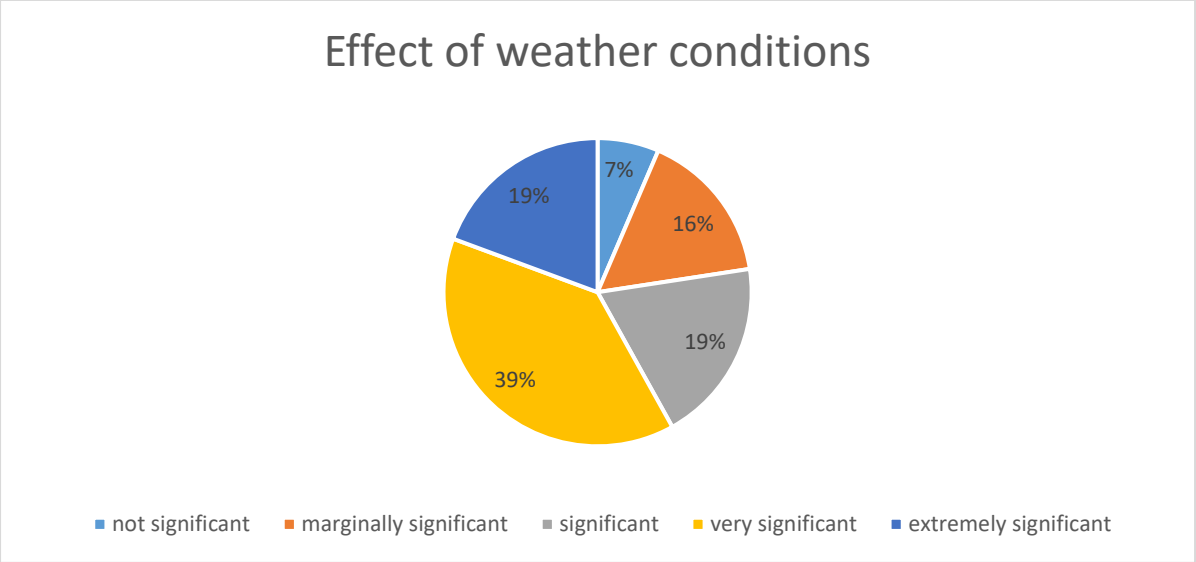
Building productivity is a vital part of a construction project, irrespective of how great your goals are. As a result, make certain you keep your contract workers on precisely the same page regarding your objective and project deadline. According to responses from IDAP experts this factor leads to be a very significant factor leading to delay in construction projects. The responses received form the experts accounting to this factor are **35%** claiming it effect the construction project and needs considerat**ion.**

Rework due to various Construction Errors



Poorly prepared contract documentation, missing reports, discrepancies in records, and inconsistencies with the project documentation can lead to construction revisions. Project design inconsistency. A poor or incomplete design that does not meet the standard specifications could lead to modifications, errors, and omissions. So, this particular factor leading to delay in construction project needs consideration. With responses of experts claiming it to be a **significant** factor leading to delay in construction projects.

Effect of weather conditions



Weather may hinder the completion of a construction project in a few different ways, including damaging equipment, obstructing visibility, disrupting the worksite, and undoing work. In this way, weather can sometimes delay completion of the construction and pose safety and working environment risks to the project and those working on it. It was seen form various progress reports and monthly basis reports that this particular factor in winter season having smog in south Punjab was causing delay in construction project. The consistency was seen from the responses of the experts as well. Making it as extremely significant factor on the rating of 1-5.

CONCLUSION

All critical delay drivers identified in the model have their unique significance depending upon their Relative Importance Index (RII) and can have a role in the delaying of projects. These critical delay drivers fetched out of literature review and subjective case studies are prioritized in accordance with their significance.

Furthermore, these critical delay drivers have a direct role to play in the effective risk management of every construction project so this study will assist client in proper risk management of various delay drivers causing Extension of Time (EOT) and scope change claims.

Also, this study will assist in accomplishment in reduction of critical delays that impact the overall lifecycle of the project making it more scheduled, cost-efficient and sustainable.

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