International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 01 | Jan - 2022 ISSN: 2582-3930

IDENTIFYING BARRIERS IN LEAN AND IMPLEMENTATION IN THE CONSTRUCTION INDUSTRY

Submitted by:

Jatin Chaudhary (1/18/FET/BCI/009)

Sarthak Mangla (1/18/FET/BCI/016)

Rahul Raghav (1/18/FET/BCI/007)

ABSTRACT

Lean construction is an emerging topic nowadays and this attracted my interest towards researching into this area. Concepts of lean construction are explained in this paper and all the barriers that were discovered from previous year research papers were surveyed according to there rankings and then the ranking of barriers is shown accordingly as a result. I have also determined the cost and time that can be saved if lean construction was implemented.

INTRODUCTION

Lean construction much like current practice has the goals of better meeting customer needs while using less of everything. But unlike current practice, lean construction rests on production management principles, the" physics" of construction. The result is a new project delivery system that can be applied to any kind of construction but is particularly suited for complex, uncertain, and quick projects.

CONCEPT OF LEAN CONSTRUCTION

The principal idea is to maximise customer value while abetting waste, furthermore, it can be simplified as a means to create more value. Lean's approach recognizes customer value and focuses on its core processes to keep you informed. The main agenda is to give total value to sponsors through the process of creating a total value with little or no waste. To achieve this, soft thinking shifts management focus from improving individual technologies, assets, departments and agencies, to improving the flow of products and services across a fairly stream of flow across all technologies, assets, and departments to customers. It also enables the movement of steps by removing non-additional functions such as resources, time or space consuming. It focuses on process improvement by reducing the length of time for each activity. The lean concept provides the basis for successful project management.

LEAN PRINCIPLES

• Find out the value: - What customers value most and what the team set the job price to differentiate value addition from waste operations. Because the price is everything the customer pays.

• Map value distribution: - Identify all the steps in the price stream of each product or family, closing the steps that do not add any value to the project in order to deliver the project successfully.

• Create flow: - Make the process of creating value in sequence so that the product will flow smoothly and with lessons that are better combined with multiplication

• Use Pull Logistics: - All components and job information are processed and provided in a timely manner and produce what customers want by avoiding delays and overproduction.

• Pursue Perfection: - A key part of a soft mindset is continuous improvement. Further improvement can be achieved with the help of a mechanism similar to the Plan-Do-Check-Act, known as the PDCA waste disposal. Lean construction is a way of designing production systems in a construction environment with the aim of decreasing time, effort, and a waste of materials.

lean construction ensures that the project is done quickly, and low costs are made during the construction process. In addition, junk construction aims to increase value and reduce costs involved during project maintenance, design, planning, and implementation. Globally, the use of Lean construction increases productivity in the construction industry.

Lean construction has the following key features:

— Concurrent design and engineering.

— Objectives that are explicitly set for the delivery process.

— Employment of project control which is implemented across the project life cycle; from design to delivery.

Everyone involved in a nonprofit building project, from builders, architects, designers, experienced owners to the final seller, is considered to ensure that the construction project is of high quality, fast delivery, and low cost.

Soft thinking principles are used while making soft construction. The hiring of flexible design principles leads to a highly profitable, flexible company.

These policies include:

— Customer's perspective is taken into consideration while defining the design value of the construction process.

— Ideas that yield to big performance gain are considered to improve the construction project performance.

— Proactive implementation of project cost and control management.

— Measuring a project planning performance to results obtained. A metric is used to define the planning to be used in lean construction.

— Specialty expertise takes precedence in solving a problem at hand that can be solved in a day over the normal process used to address the same problem in a week.

You should care about lean construction as the following benefits can be achieved while applying lean thinking in a building project:

— Production of quality profit margins

— Protecting the environment and respecting the workers ensures better social infrastructure.

— Employment of youth talents in the construction industry as lean construction provides a healthy, and pleasant environment.

Soft design and the issue of construction as a building material asset is built in a systematic way. The results obtained have an impact on everyone involved in the construction process. This ranges from owners with construction experience to teams using the construction site. Tenants living in a building built under Lean design, compared to the conventional approach, receive significant savings on rental costs. This is because the cost and recovery point are considerably lower while using a softer design method.

The diminished construction design focuses on sustainable construction practices that are environmentally friendly and ensure green business processes. This method also uses solar energy thus increasing energy consumption while designing a building trail. In addition, the use of non-abrasive design results in the

production of minimal construction waste, as well as by-products that are environmentally friendly. The results are suitable for both direct and indirect community participants.

Lean construction designs lead to competition amongst construction providers. Domestic construction companies being at a better fighting position improves local economy as well as increasing job markets.

MOTIVATION

Over the years, many companies and organizations have attempted to integrate Lean into their processes. Doing so seems to be costly, time-consuming, difficult to measure, difficult to sustain, and, most disappointingly, fails to yield results that justify the investment in time and effort .

These problems are deeply ironic, given one of the stated intentions of a Lean integration.

“In short Lean thinking is lean because it provides a way to do more and more with less and less—less human effort, less equipment, less time, and less space—while coming closer and closer to providing customers with exactly what they want.”

OBJECTIVES

To determine the major barriers in the Construction of a multi storey building and its solution by lean construction methodology.

LITERATURE REVIEW

In the survey of the previous year papers, we have found that the concept of lean construction is getting more important in our construction sites as well as the concept of lean is important is getting importance in our day to day lives. Through the studies of the various papers, we can find that identification of the barriers of lean construction Implementation in construction projects. In the developing countries the, investigation is concerned with two main topics

- Feasibility study and investigation into awareness of lean construction.
- Discovering the barriers to the implementation of lean construction.

Lean construction is termed as a “Way to design production systems to minimize waste of materials, time, and effort,

There are various techniques for minimizing the risks effect on project construction time. These techniques help to save to save time and time is equal to money and saves the money of the contractor if the project. Thew time overrun was a quantified based on the probabilities of occurrences and the impacts of many risks factor on the project time using a time overrun quantification model.

We have accessed the impacts of implementation of lean construction by using the LPS (Lean Planner System) is an effective tool to improve reliability of planning in projects. Improvements in PPC are usually accompanied by a more stable and less variable performance of the PPC indicator.

We have found that the lean construction is an agenda for research into system and organisation to articulate a research agenda which aims to extend the focus of LC from the task level, which has hitherto been its primary referent, to wider considerations of system and organisation.

- **Integrating Lean Construction and Sustainability via a System Dynamics Framework: -**

The relationship between lean and sustainability warrants a deeper understanding to assimilate the trade-offs across economic, social and environmental parameters. Even though the existing studies in this domain establish the relationship between lean and sustainability, they are greatly diverse in their approaches thus creating a fragmented understanding, and does not collectively analyse the various interrelationships and the feedbacks.

- **IMPLEMENTING LEAN CONSTRUCTION: UNDERSTANDING AND ACTION: -**

  Implementation requires action be shaped by a deeper understanding of the goals and techniques and explains the implications of the goals and key production principles, and how when taken together they result in a different way to manage construction. Implementing lean in construction then becomes a matter of developing and acting on this new knowledge. Advice on implementation is offered.

- **Lean construction and simulation for performance improvement: a case study of reinforcement process: -**

  To evaluate the impact of applying lean construction principles on the performance of reinforcement operations using a discrete-event simulation (DES) approach. Design/methodology/approach Process mapping of reinforcements operations was first established through field observation and interviews with construction managers involved in the selected project.

- **Barriers to adopting lean construction in the construction industry: a literature review**

To identify and theoretically explain the general barriers to adopting lean construction practices in the construction industry regardless of the country or the company size or specialization, and to suggest future research studies in this field.

- **Implementation of lean construction in the construction industry in Bangladesh: awareness, benefits and challenges**

Construction management is enriched in many ways by direct and indirect support of lean construction concept. The objectives of this study are to assess the current level of awareness about lean construction practice, to identify the potential benefits and challenges to implement lean construction in the Bangladeshi construction industry and to prioritize them.

- **Barriers to integrating building information modelling (BIM) and lean construction practices on construction mega-projects: a Delphi study**

  The construction industry encounters substantial challenges in its evolution towards sustainable development and in the adoption of building information modelling (BIM) technology and lean construction (LC) practices on construction mega-projects. This research aims to investigate the critical barriers encountered by key construction stakeholders in their efforts to integrate BIM and LC in the construction mega-projects.

- **Barriers to lean construction implementation in Zimbabwe**

  Increased waste during projects execution has led to time and cost overruns within the Zimbabwean construction projects industry. However, contextual barriers to lean construction implementation are yet to be established for derivation of effective remedies. The purpose of this paper is to report on a study that sought to determine barriers to lean construction implementation and assess the existence of statistically significant differences because of gender, designation and educational levels of respondents.

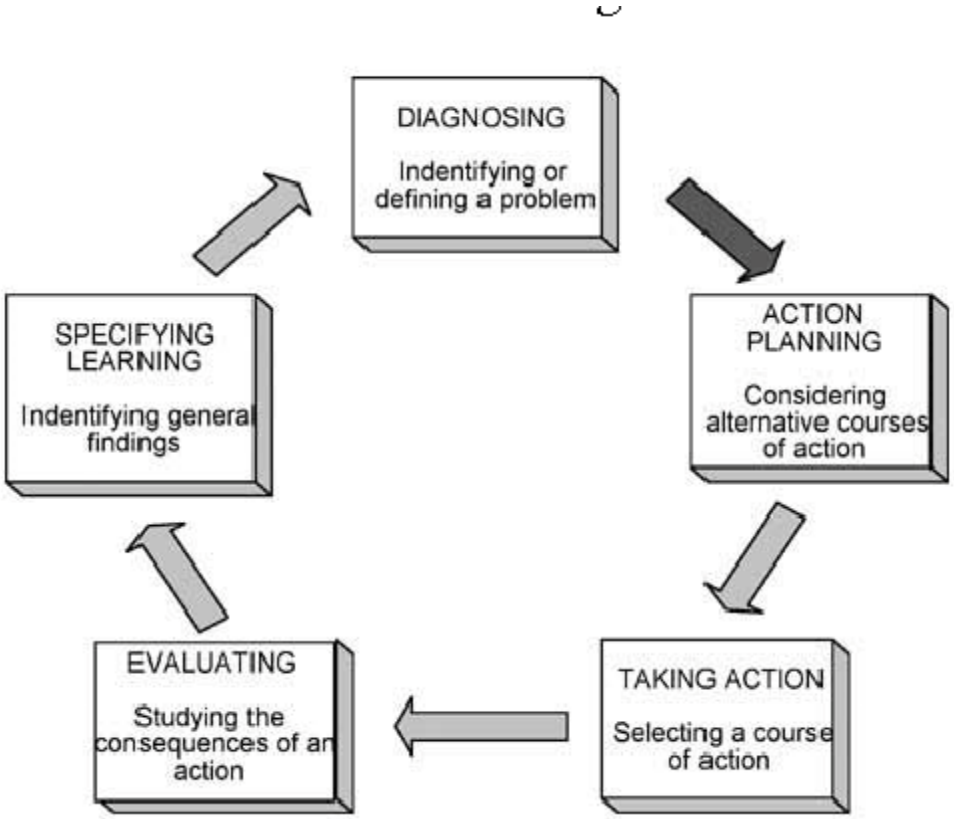
- **BIM, Augmented and Virtual Reality empowering Lean Construction Management: a project simulation game**

Lean Management methodologies established in the manufacturing environment have been applied and adapted to the construction industry under the term “Lean Construction”. Currently, concepts and technologies from Industry 4.0 are mainly transforming the manufacturing industry and only few applications have been implemented to construction and its connected supply chains. This paper

shows how new technologies like Building Information Modelling connected with Virtual and Augmented Reality could empower Lean Construction methodologies to increase efficiency during the building execution process.

- **Lean construction and BIM in small and medium-sized enterprises (SMEs) in construction: a systematic literature review**

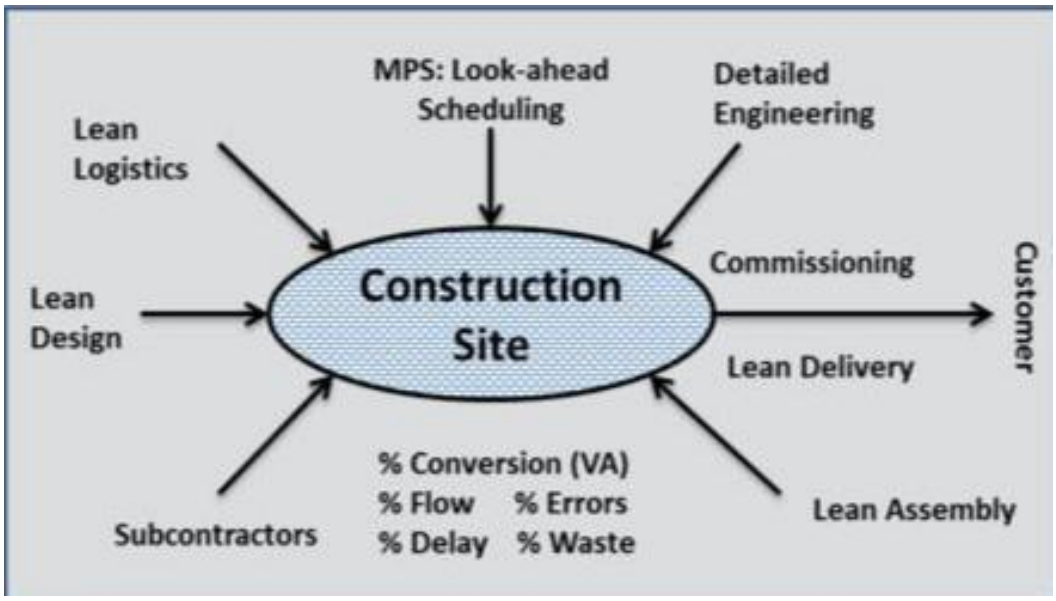
Lean Construction (LC) and Building Information Modelling (BIM) are two of the prominent concepts challenging the traditional practices in construction management. Small and medium-sized enterprises (SMEs) often constitute the largest group in construction supply chains. Increasing BIM and LC adoption amongst SMEs is a key condition for achieving the transformation of the construction industry through BIM and LC.



PROBLEM STATEMENT: -

Apart from a small circle of researchers, Lean, as the concept was named by Krafcik (1988), was unknown in most of the world during its inception. With the publication of The Machine that Changed the world by Womack et al. (1990), awareness grew. With the subsequent publication of Lean Thinking by Womack and Jones (2003), the manufacturing world, with the car industry at the forefront, received a recipe addressing one of the oldest problems in manufacturing.

Over the years, interest in Lean had ebbed and flowed but never wholly abated, despite rarely fulfilling promises made in Lean Thinking (Seder lad, 2013). Researchers spent quite some time and effort gathering information and conducting studies, attempting to find the missing link or to understand what the key ingredients were, generating numerous different perspectives and views of what Lean actually was and was not (Stone, 2012; Lang strand and Drotz, 2016).



METHODOLOGY

After reading all the research papers we found the six most affecting barriers of lean construction. The questionnaire was prepared after sheer study of literature and by understanding the lean construction techniques with their benefits and challenges. The questionnaire survey was created with help of an online Google form and was mailed to construction firm.

Site selection

Amrita Institute of Medical Sciences

Sector-88

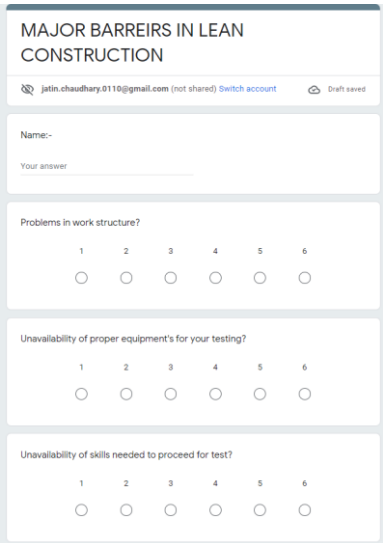
Greater Faridabad

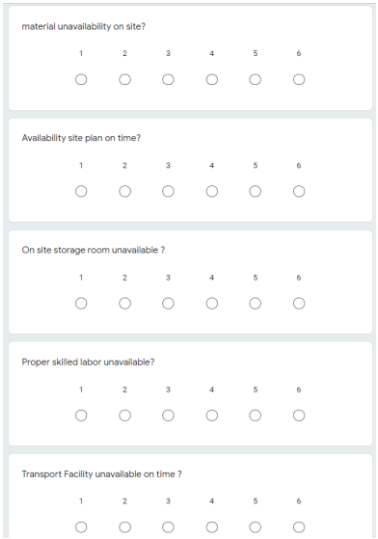
Construction of a hospital is going on , we surveyed the employees there by helping them in filling google form and to determine the major barriers of lean construction.

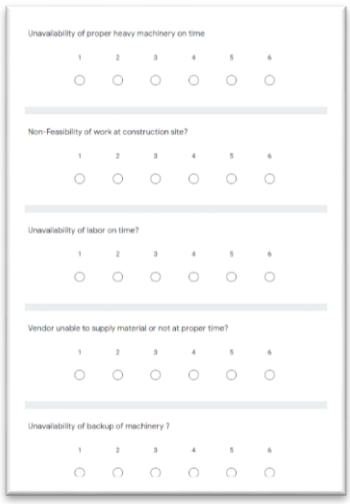
The questions in the survey were based on the previous literature studies conducted on this topic. The questionnaire is given below: -

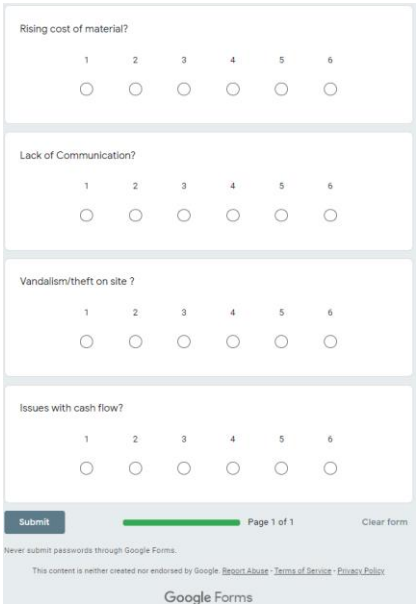
1. Problems in work structure?
2. Unavailability of proper equipment's for your testing?
3. Unavailability of skills needed to proceed for test?
4. Proper distribution of works for labor?
5. Unavailability of proper heavy machinery on time
6. Non-Feasibility of work at construction site?
7. Unavailability of labor on time?
8. Vendor unable to supply material or not at proper time?
9. Unavailability of backup of machinery?
10. Rising cost of material?
11. Lack of Communication?
12. Vandalism/theft on site?
13. Issues with cash flow?
14. Material shortage?
15. material unavailability on site?
16. Availability site plan on time?
17. On site storage room unavailable?
18. Proper skilled labour unavailable?
19. Transport Facility unavailable on time?
20. Unavailability of lift/crane for unloading materials?
21. Weather issues on site?
22. Delays due to changes in plan?

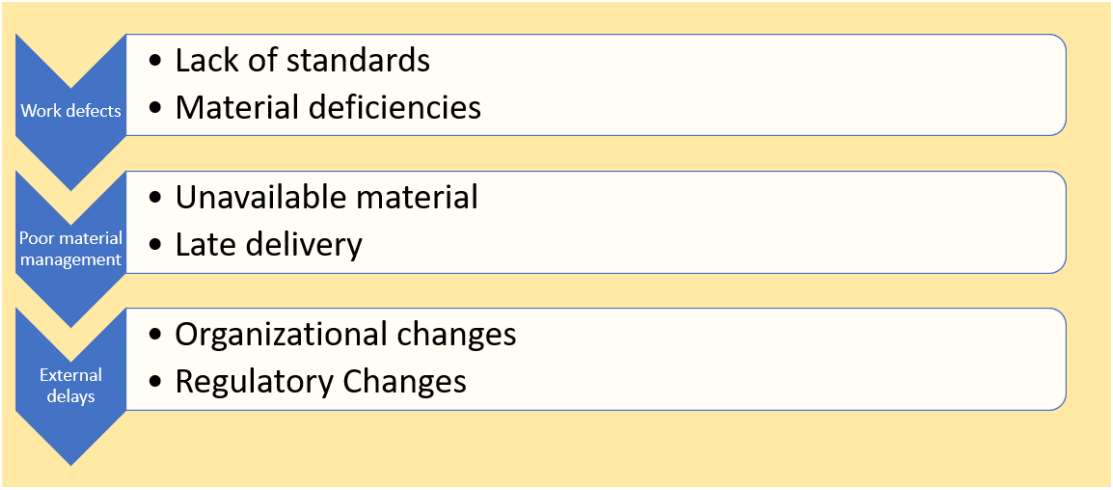
Google Form link:- https://forms.gle/64KtojLj18SXnFs49

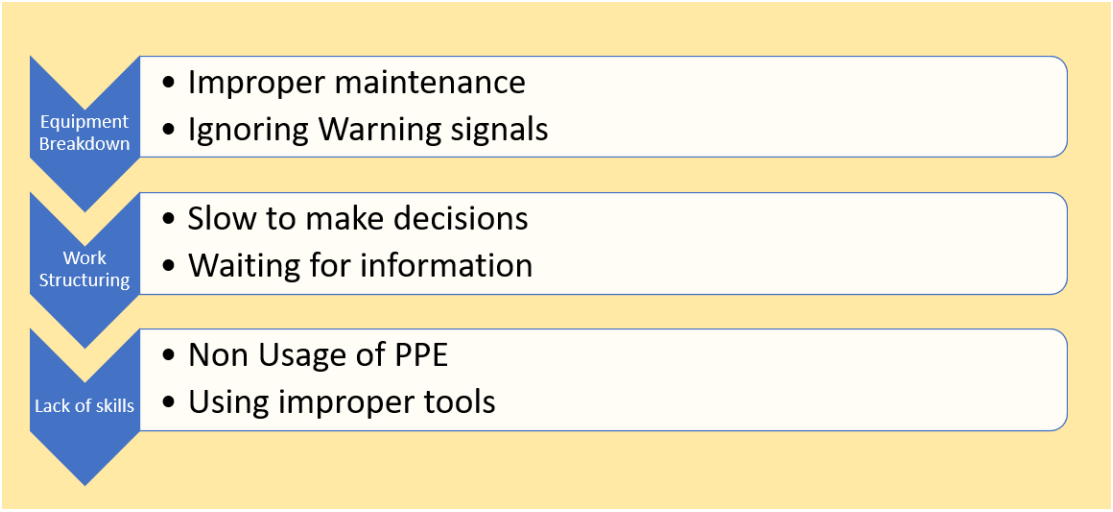







Rising cost of material?
1 2 3 4 5 6
Lack of Communication?
1 2 3 4 5 6
Vandalism/theft on site ?
1 2 3 4 5 6
Issues with cash flow?
1 2 3 4 5 6
Submit
Page 1 of 1
Clear form
Never submit passwords through Google Forms.
This content is neither created nor endorsed by Google. Report Abuse - Terms of Service - Privacy Policy
Google Forms


Work defects
• Lack of standards
• Material deficiencies
Poor material management
• Unavailable material
• Late delivery
External delays
• Organizational changes
• Regulatory Changes


Equipment Breakdown
• Improper maintenance
• Ignoring Warning signals
Work Structuring
• Slow to make decisions
• Waiting for information
Lack of skills
• Non Usage of PPE
• Using improper tools

Those Questions were framed in ranking format so that they can be easily answered and wouldn't take much time. Some questions listed were asked to scale from 1 to 6 with respect to their probability of occurrence. The targeted population included civil engineering professionals including contractors, site engineers, government employees, project managers, builders, architects etc. And they were requested to answer the same as per their perspective. The questions were asked in the survey which was pertinent to the major barriers to implementing the method. The answers were analysed on the probability of their occurrence and the most probable barriers are listed in the result. The answers to the questionnaire received were compiled so that we could have a lucid view of the most probable barrier.

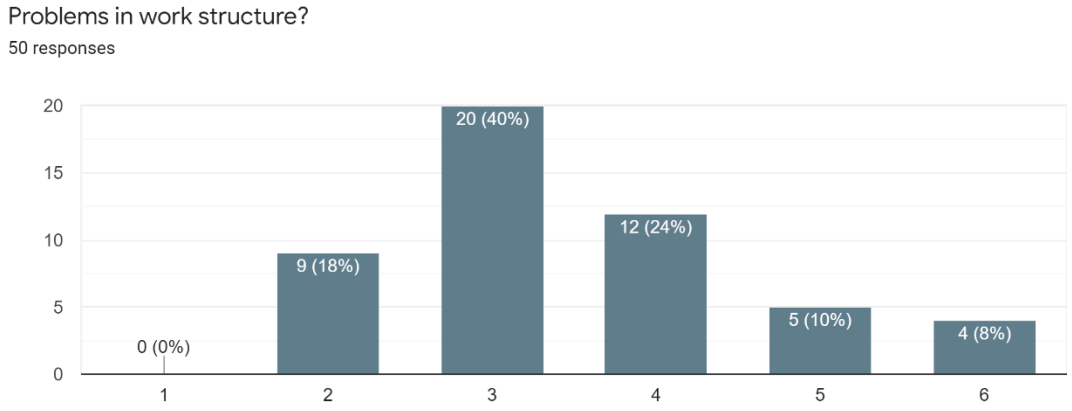
OUTCOMES

The questionnaire was sent to construction firm and employees, but due to busy schedules some employees neglected to answer and 50 responses were collected. The initial aspect of the questionnaire captured the respondent's characteristics concerning their vocation, qualifications, years of experience in the industry, the name of the firm. Table below demonstrates the major barriers found by the employees. The answered results were compiled in an excel sheet.

Name:-	Problems in work structure ?	Unavailability of proper equipment's for your	Unavailability of skills needed to proceed	material unavailability on site?	Availebility site plan on time?	On site storage room unavailable ?	Proper skilled labor unavailable?	Transport Facility unavailable on time ?	Unavailability of lift/crane for unloading materials	Weather issues on site ?	Delays due to changes in plan ?	Material shortage ?	Proper distribution of works for labor ?	Unavailability of proper heavy machinery on time	Non-Feasibility of work at construction site?	Unavailability of labor on time?	Vendor unable to supply material or not at proper	Unavailability of backup of machinery ?	Rising cost of material?	Lack of Communication?	Vandalism/theft on site ?	Issues with cash flow?
Manoj	3	5	2	3	5	2	4	2	5	1	5	3	6	5	1	5	2	4	3	5	2	4
Mukesh	3	2	5	1	6	5	3	4	2	1	6	4	5	2	3	5	4	1	6	5	2	3
Sashank	5	1	4	1	5	1	3	6	3	5	2	6	4	3	5	2	1	3	2	4	3	5
Pappu	2	4	1	5	4	6	1	4	2	4	3	5	1	2	4	3	6	5	6	4	5	2
Sourav	2	1	6		3	5	1	2	4	3	5	2	3	6	2	4	1	5	4	3	2	6
Ankit	3	2	5	4	1	6	4	2	4	2	5	1	5	1	6	4	5	5	1	6	3	4
Tushar	3	1	2	4	5	3	6	2	1	4	5	6	1	2	4	3	5	1	4	2	5	2
Chirag	3	1	5	3	4	1	6	5	4	4	3	4	3	4	2	6	5	1	4	1	4	3
Risabh	3	1	5	4	6	2	3	5	2	3	6	2	5	1	4	2	3	2	5	6	4	4
Vansh	4	3	2	5	1	6	4	2	4	2	4	3	2	5	3	4	1	4	2	4	1	5
Naman	2	4	2	5	1	6	4	1	5	4	2	5	6	1	3	4	2	4	2	5	3	5
Sapna	4	1	1	3	6	2	3	4	2	5	3	1	4	3	3	2	4	2	1	5	4	1
Sonali	3	1	1	5	1	6	5	2	3	1	4	5	6	3	4	2	4	5	3	4	1	4
Aditi	4	1	1	3	2	5	6	4	3	1	4	5	2	3	5	2	2	4	3	3	4	2

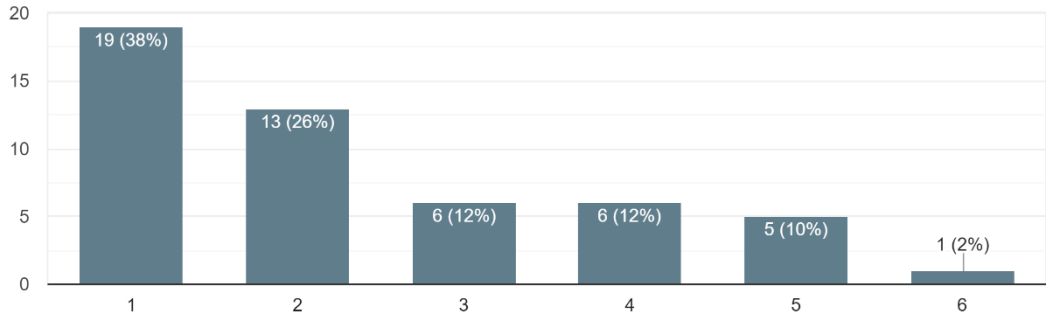
Name:-	Problems in work structure ?	Unavailability of proper equipment's for your	Unavailability of skills needed to proceed	material unavailability on site?	Availability site plan on time?	On site storage room unavailable ?	Proper skilled labor unavailable?	Transport Facility unavailable on time ?	Unavailability of lift/crane for unloading materials	Weather issues on site ?	Delays due to changes in plan ?	Material shortage ?	Proper distribution of works for labor ?	Unavailability of proper heavy machinery on time	Non-Feasibility of work at construction site?	Unavailability of labor on time?	Vendor unable to supply material or not at proper	Unavailability of backup of machinery ?	Rising cost of material?	Lack of Communication?	Vandalism/theft on site ?	Issues with cash flow?
Deepak	4	1	4	2	2	5	5	4	6	3	4	2	4	2	3	3	1	2	4	3	5	5
Vikas	3	1	4	2	3	5	6	3	6	4	3	5	4	1	2	4	3	3	2	4	3	6
Amit	3	1	4	3	5	1	6	5	4	3	3	2	5	5	4	4	2	6	4	2	6	1
Pankaj	3	1	4	2	5	6	2	3	4	3	5	4	3	3	6	2	2	3	1	5	6	3
Sanjana	4	2	2	6	5	2	3	1	4	3	5	6	3	2	4	2	5	3	2	1	3	5
Prema	4	1	1	5	3	5	1	3	3	5	6	4	3	6	2	3	4	1	4	6	2	4
Pulkit	4	2	5	2	1	5	2	3	4	1	6	5	6	4	1	3	4	2	5	5	1	1
Devashish	4	1	5	2	6	5	4	3	2	1	5	3	4	2	4	6	3	4	5	2	3	6
Akhil	5	5	1	3	1	2	6	4	1	4	4	5	2	4	4	3	1	3	2	3	5	2
Parveer	4	1		2	5	3	4	4	5	4	3	4	2	5	6	4	3	4	6	4	1	2
Radhika	3	1	4	4	5	3	2	5	6	5	2	3	4	2	4	1	2	6	4	3	3	4
Nawab	5	4	2	6	5	1	3	2	4	5	6	2	3	1	4	3	4	3	5	3	4	2
Kuwna	5	3	3	2	1	6	5	4	3	2	5	2	4	3	1	5	4	3	6	4	2	3
Digvijay	5	2	3	6	1	3	2	4	6	1	5	3	4	2	3	5	3	4	2	4	5	6
Nanda	3	2	1	5	6	5	4	3	4	2	3	3	6	1	2	3	3	5	4	4	3	2
Toiss	6	3	4	2	4	4	2	5	4	2	4	2	6	5	1	2	3	1	4	5	6	3
Yashika	4	1	2	5	6	3	3	5	4	2	2	1	4	5	3	6	4	2	4	2	4	3

Name:-	Problems in work structure ?	Unavailability of proper equipment's for your	Unavailability of skills needed to proceed	material unavailability on site?	Availability site plan on time?	On site storage room unavailable ?	Proper skilled labor unavailable?	Transport Facility unavailable on time ?	Unavailability of lift/crane for unloading materials	Weather issues on site ?	Delays due to changes in plan ?	Material shortage ?	Proper distribution of works for labor ?	Unavailability of proper heavy machinery on time	Non-Feasibility of work at construction site?	Unavailability of labor on time?	Vendor unable to supply material or not at proper	Unavailability of backup of machinery ?	Rising cost of material?	Lack of Communication?	Vandalism/theft on site ?	Issues with cash flow?
Gajendar	4	1	2	5	6	3	4	1	3	2	4	5	6	3	4	2	1	5	4	3	2	3
Surender	2	3	1	5	4	6	4	2	4	3	5	3	2	1	4	4	3	6	5	4	3	2
Virender	2	6	5	1	2	4	3	5	3	1	3	6	5	3	1	4	3	2	3	6	4	2
Rajat	3	2	5	4	3	6	1	3	5	4	5	2	6	3	1	4	2	3	4	3	5	4
Manish	6	2	3	1	5	4	3	5	6	2	4	2	4	4	1	5	6	4	2	4	2	5
Ruchi	4	2	2	6	5	4	1	5	2	6	3	6	2	1	4	5	2	5	2	4	3	3
Munesh	2	3	3	1	5	6	5	3	4	3	5	6	1	2	3	4	2	3	1	4	2	5
Varun	3	1	5	3	4	1	6	4	2	3	2	3	2	4	3	1	6	4	5	4	5	3
Sanskriti	6	5	2	4	3	3	4	4	1	2	4	3	5	3	1	2	5	3	3	3	6	5
Rajender	3	5	4		2	3	1	4	4	2	3	6	1	1	4	3	3	2	3	2	5	3
Rafik	6	4	4	2	4	1	2	4	6	1	4	3	2	4		2	5	4	3	1	6	4
Lalit	3	2	4	4	1	5	2	3	4	2	6	3	3	2	5	3	4	2	4	2	4	2
Shubha	3	2	5	1	5	3	4	5	6	3	4	2	4	3	2	4	2	5	1	2	3	5
Ajay	3	2		2	5	4	1	6	4	3	5	1	3	2	4	2	4	2	4	2	5	2
Anup	3	5	2	4	1	4	2	3	6	4	3	3	2	4	5	2	2	1	4	3	5	3
Divya	2	4	5	1	5	4	3	6	3	3	3	4	2	4	5	3	5	2	5	3	4	4
Mohit	3	2		6	4	2	3	4	2	6	4	3	1	4	2	5	2	6	2	4	2	4
Zamzar	2	4	1	5	3	5	3	4	3	4	3	2	3	3	2	5	4	3	3	2	6	5
Anushka	2	3	5	4	3	4	4	2	1	2	3	3	2	5	5	2	1	3	5	6	3	5



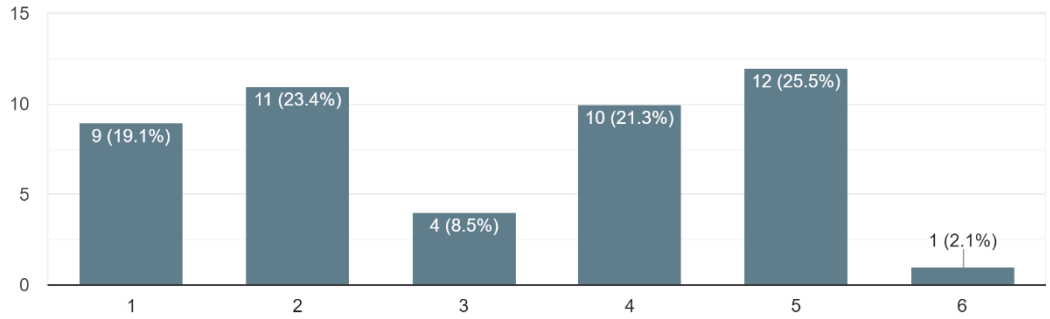
Unavailability of proper equipment's for your testing?

50 responses



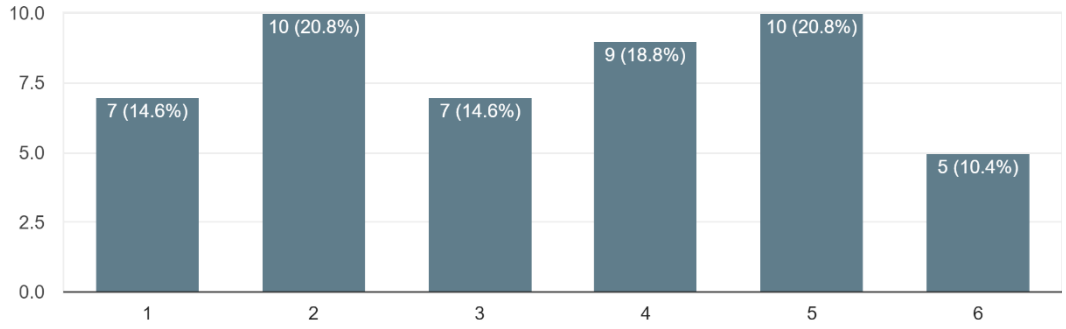
Unavailability of skills needed to proceed for test?

47 responses



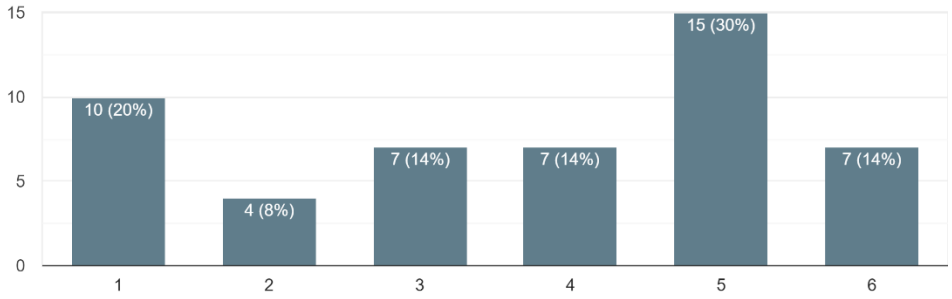
material unavailability on site?

48 responses



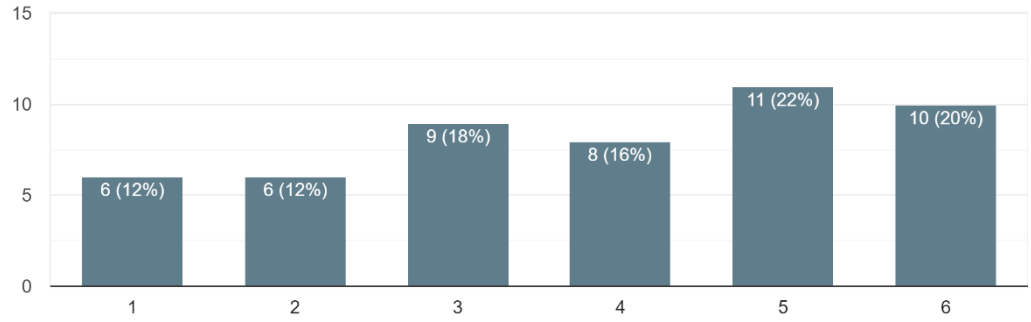
Availability site plan on time?

50 responses



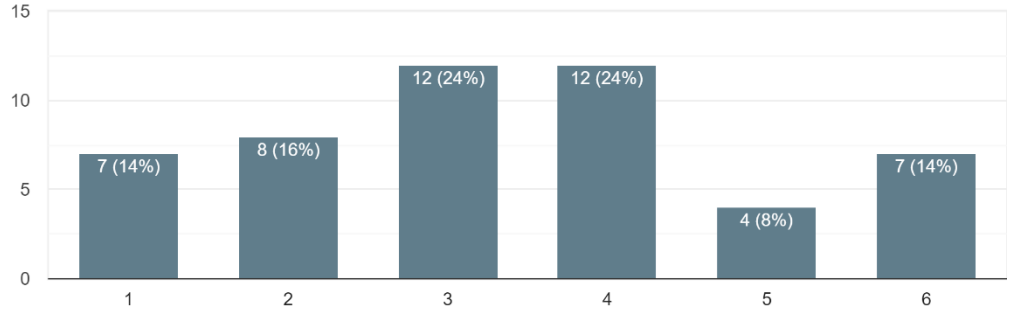
On site storage room unavailable ?

50 responses



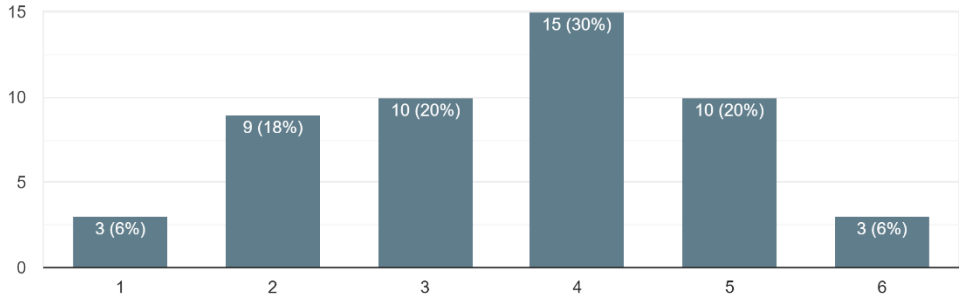
Proper skilled labor unavailable?

50 responses



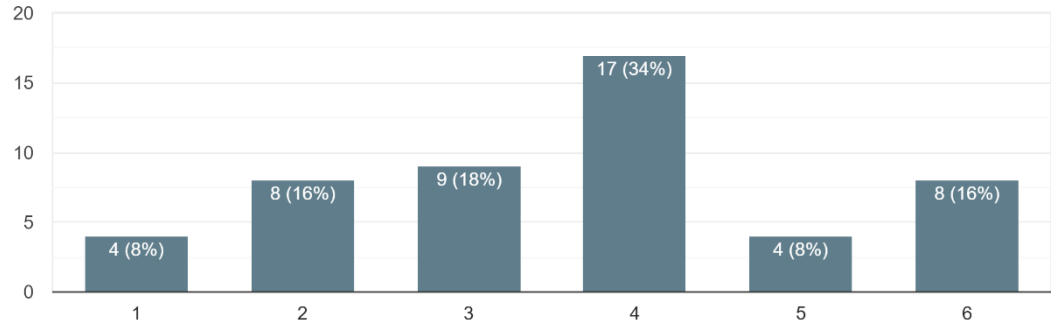
Transport Facility unavailable on time ?

50 responses



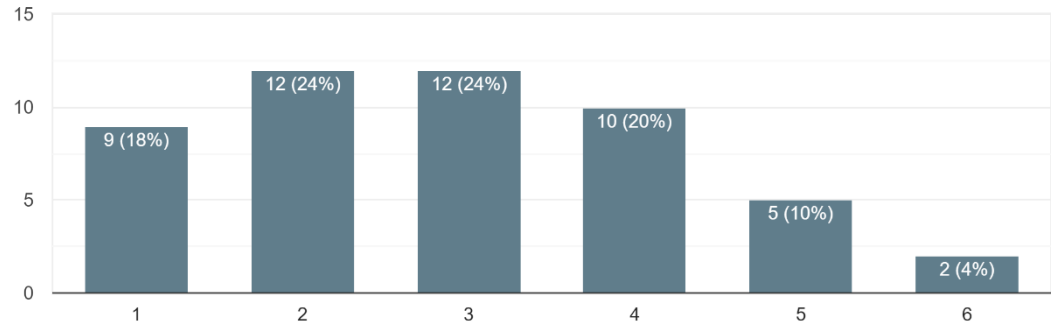
Unavailability of lift/crane for unloading materials?

50 responses



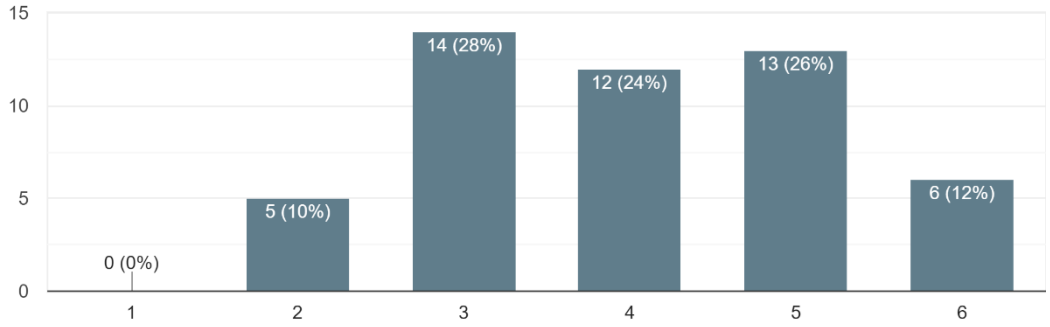
Weather issues on site ?

50 responses



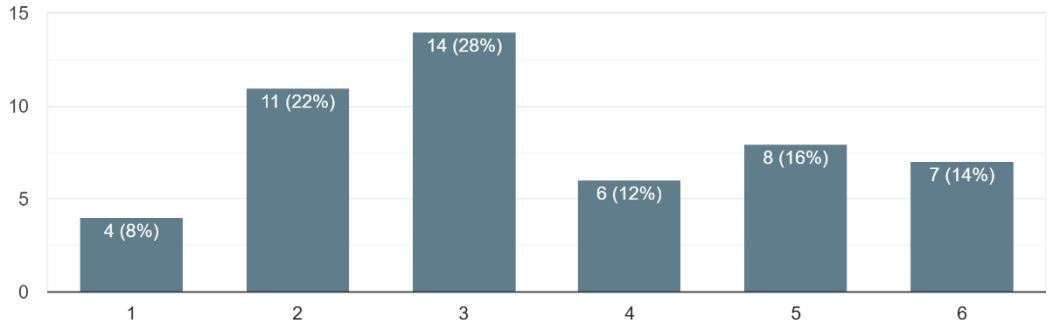
Delays due to changes in plan ?

50 responses



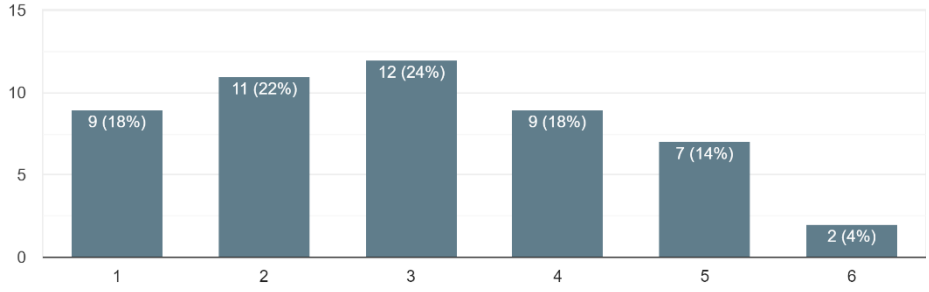
Material shortage ?

50 responses



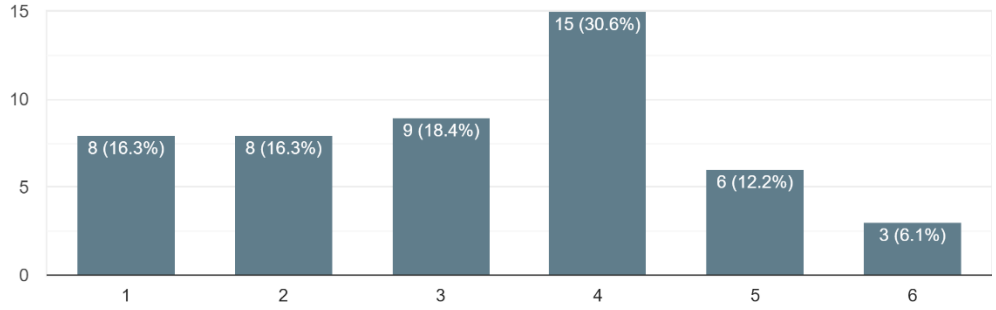
Unavailability of proper heavy machinery on time

50 responses



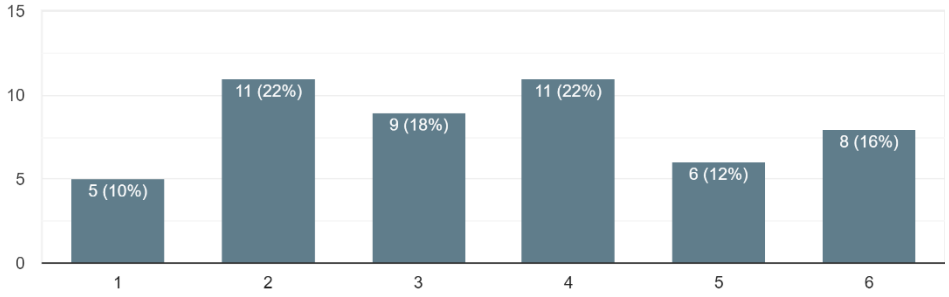
Non-Feasibility of work at construction site?

49 responses



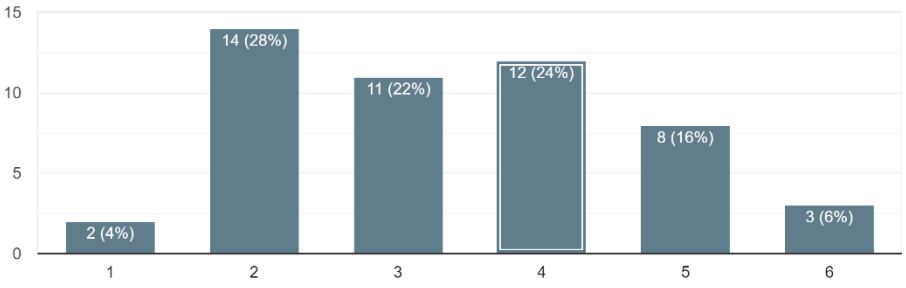
Proper distribution of works for labor ?

50 responses



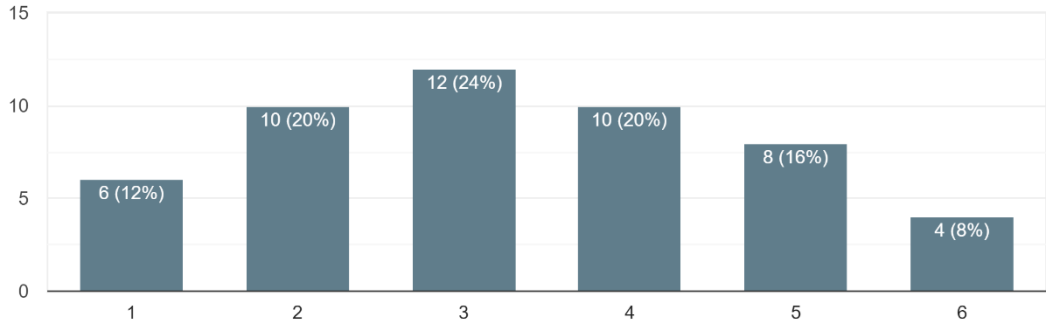
Unavailability of labor on time?

50 responses



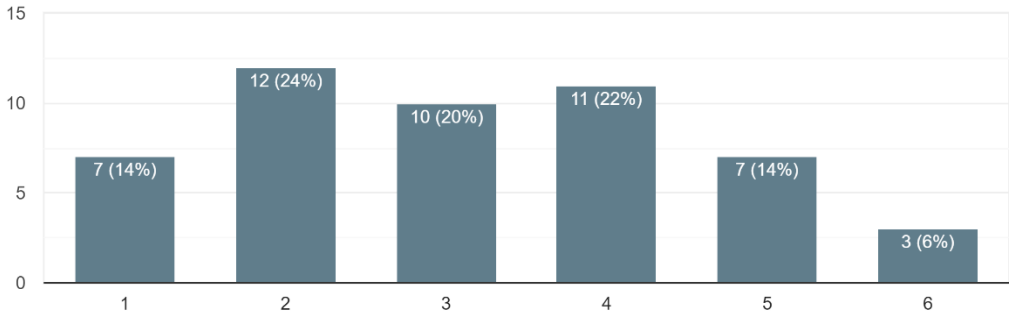
Unavailability of backup of machinery ?

50 responses



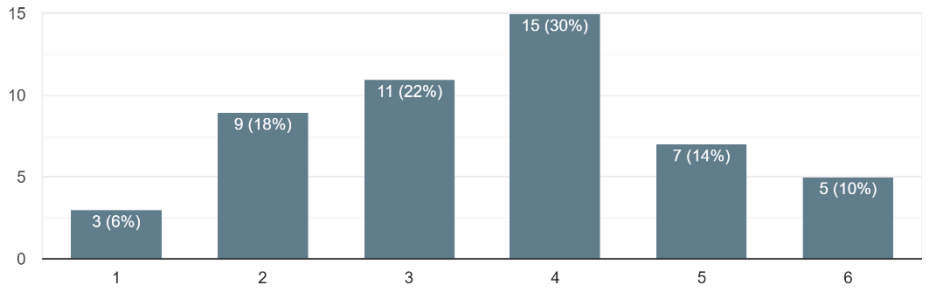
Vendor unable to supply material or not at proper time?

50 responses

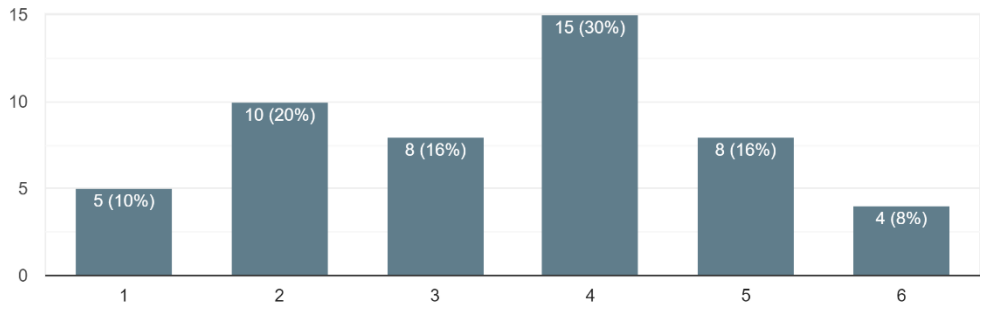


Lack of Communication?

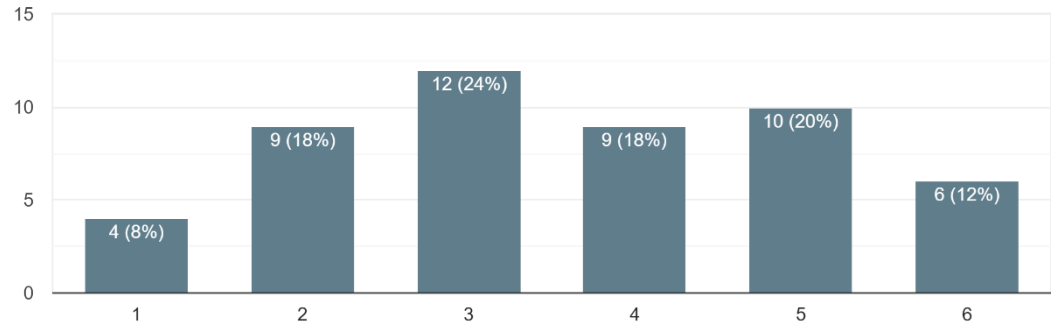
50 responses



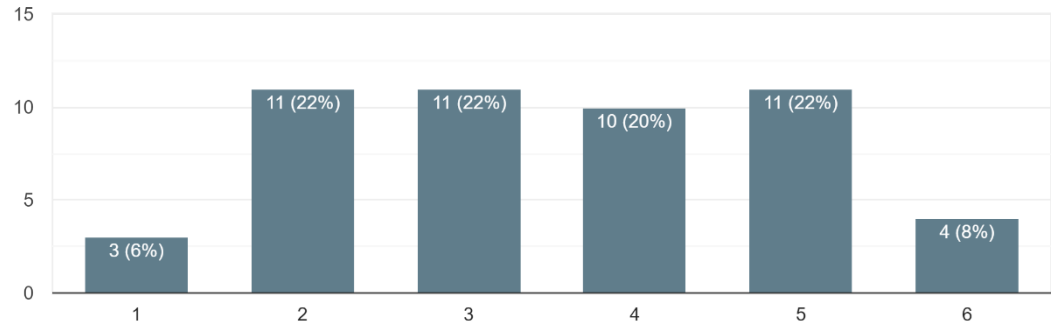
Rising cost of material?
50 responses



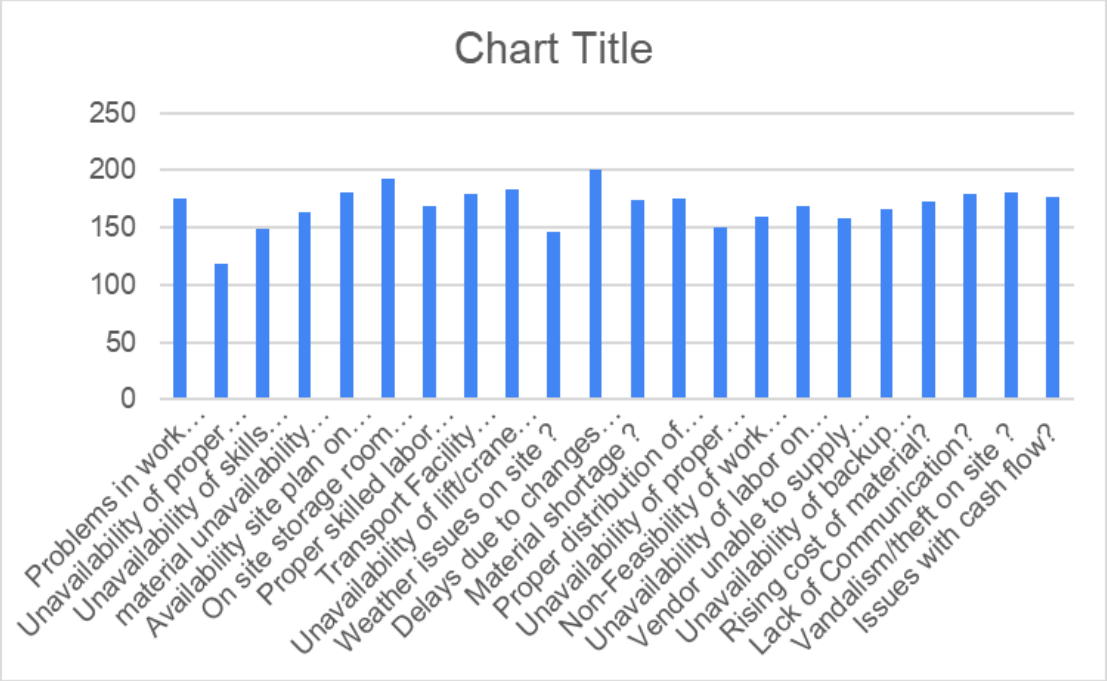
Vandalism/theft on site ?
50 responses



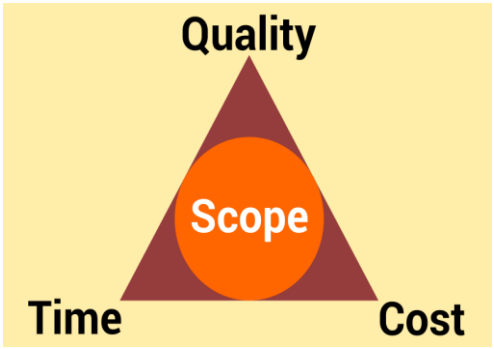
Issues with cash flow?
50 responses



Results: -



- **Delay due to change in plan** was the most voted barrier according to the people working at the construction site.
- The second most voted barrier was **unavailability of onsite storage room** due to which
- The third most voted barrier was **Unavailability of lift/crane for unloading material**.



CONCLUSION

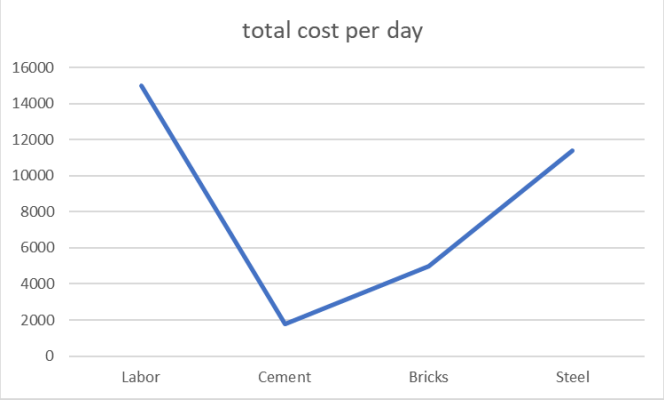
- **Delay due to change in plan**

Average **cost of a labour is 500-700 rupees/day.** Due to change in plan we have to start over constructing the part of plan that had been changed so it requires time, money, material, and more labour hours.

We should have a 15-day final plan so that there are no sudden changes or obstruction to work flow.

Quality is compromised due to overcome delay and complete the work till deadline.

Total cost per day that can be saved if we use Lean construction: -



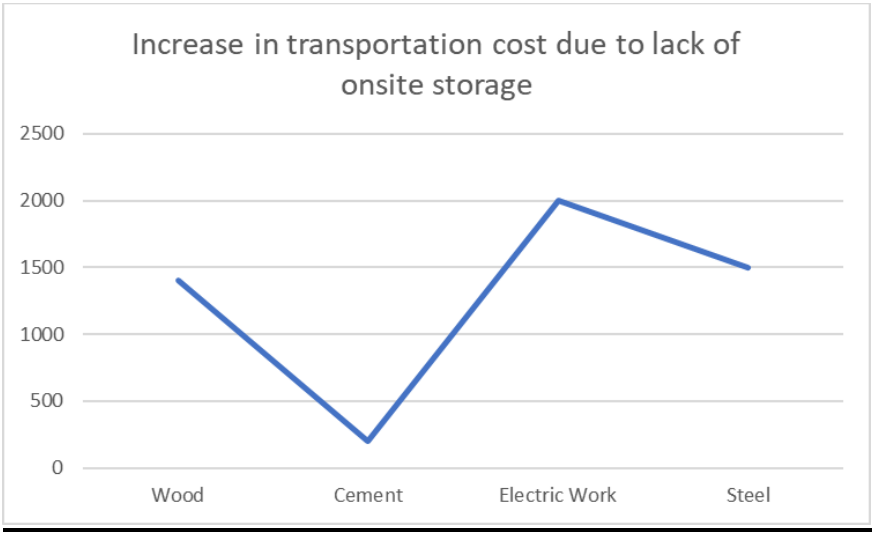
Items	No. of items	cost per item	total cost per day
Labor	30	500	15000
Cement	4 bags	450	1800
Bricks	1000	5	5000
Steel	60 kg	190	11400

- **Uunavailability of on-site storage room**

We should have **at least 2 storage rooms** so that we should not face any material shortage and to avoid theft and ensure security of the machinery/materials.

We can buy the appropriate material at an appropriate time so that we should not face any immediate price hike due to which the cost of production may increase.

Total Transportation cost per day that can be saved if we use Lean construction.

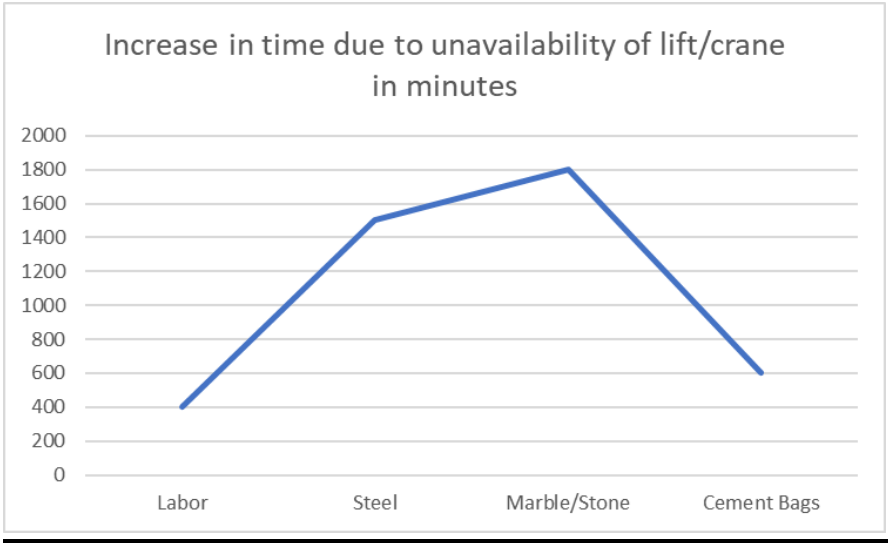


Items	No. of items	Transportaion cost per item	Increase in transportation cost due to lack of onsite storage
Wood	200	7	1400
Cement	100 bags	2	200
Electric Work	200	10	2000
Steel	500 kg	5	1500

- **Unavailability of lift/crane for unloading material**

Lift/crane are used in various processes, one of which is unloading materials and if any of these is unavailable then we have to put some labor to this task which will cost us time and money, if a crane/lift can do a work in 1 day then human labor may take around 5 days to complete this task because it is difficult for human labor to unload the material at a multistorey level.

Total Time per day that can be saved if we use Lean construction.



Items	No. of items	Time Taken By Labor to Transfer a single item	Increase in time due to unavailability of lift/crane in minutes
Labor	40	5-10 minutes	400
Steel	50	25-30 minutes	1500
Marble/Stone	40	30-45 minutes	1800
Cement Bags	30	15-20 minutes	600

FUTURE SCOPE

- From the outcomes of the result, the study now concludes that there were barriers in construction industry, which was identified and evaluated.
- The dominant barrier in the findings was delay due to change in plan . To overcome this barrier practitioners could use new technologies like BIM modelling, make preschedules, update daily tasks in an online portal, or train the employees and make them aware of novel methods which are dominant in the market.
- The second barrier, unavailability of on site storage room, can be prevailed by making parametric estimates rather than detailed estimate or by curtailing time in the ordering process.
- Furthermore, other major obstacles were pertinent to waste, culture and human attitudinal issues, and lack of coordination and communication. These can be subdued by proper material management, motivating the employees/workers, and improving communication technique between different agencies. The findings of this study could prove valuable to other states in India as well as in other countries.
- Finally, more research and primordial need to carry out case studies in different construction companies to conceive a roadmap for lean construction implementation in the construction industry.

REFFRENCES

1. Identification of the Barriers of Lean Construction Implementation in Construction Projects- A Review 2020
2. Implementation of lean construction techniques for minimizing the risks effect on project construction time 2013
3. AN OVERVIEW OF THE CONCEPT OF LEAN CONSTRUCTION AND THE BARRIERS IN ITS IMPLEMENTATION
4. LEAN CONSTRUCTION WITH OR WITHOUT LEAN – CHALLENGES OF IMPLEMENTING LEAN CONSTRUCTION

5. Implementation Of Lean Concepts in The Construction Engineering Project
6. Integrating Lean Construction and Sustainability via a System Dynamics framework
7. LEAN CONSTRUCTION: TOWARDS AN AGENDA FOR RESEARCH INTO SYSTEMS AND ORGANISATION
8. Site Implementation and Assessment of Lean Construction Techniques
9. IMPLEMENTING LEAN CONSTRUCTION: UNDERSTANDING AND ACTION
10. Lean construction and simulation for performance improvement: a case study of reinforcement process
11. Barriers to adopting lean construction in the construction industry: a literature review
12. implementation of lean construction in the construction industry in Bangladesh: awareness, benefits and challenges
13. Barriers to integrating building information modelling (BIM) and lean construction practices on construction mega-projects: a Delphi study
14. Barriers to lean construction implementation in Zimbabwe
15. BIM, Augmented and Virtual Reality empowering Lean Construction Management: a project simulation game
16. Lean construction and BIM in small and medium-sized enterprises (SMEs) in construction: a systematic literature review