

Report On Study of Supply Chain of Construction Materials During Post-Pandemic Period for Public Sector Procurement

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An internship report submitted to the BRAC Institute of Governance and Development
(BIGD) in partial fulfillment of the requirements for the degree of
MASTERS IN PROCUREMENT AND SUPPLY MANAGEMENT (MPSM)

BRAC Institute of Governance and Development (BIGD)
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Declaration

It is hereby declared that

1. The internship report submitted is my/our own original work while completing degree at BRAC University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Letter of Transmittal

Shah Eyamin Ul Islam
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Subject: Submission of report on “Study of Supply Chain of Construction Materials During Post-Pandemic Period for Public Sector Procurement”

Dear Sir,

I am pleased to submit the report “Study of Supply Chain of Construction Materials During Post-Pandemic Period for Public Sector Procurement”. This report provides a comprehensive analysis of the supply chain disruption issues faced by the construction industry during the COVID-19 pandemic and an assessment of the current state of the construction materials supply chain in the post-pandemic period. It covers trends in material prices, availability and demand, logistics and transportation challenges, vendor performance, and the impact on construction projects. The report provides strategic recommendations for managing ongoing supply chain risks and improving resilience for future disruptions. Actionable solutions provided relate to supplier selection, procurement strategy, inventory buffering, logistics partnerships, workforce development and contingency planning. Hopefully, you will find my work and effort, informative approach, and well-researched report useful.

Sincerely yours,

Partha Sarathi Datta
21382024
BRAC Institute of Governance and Development (BIGD)
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Date: January 05, 2024.

Non-Disclosure Agreement

This agreement has made and entered into by and between Public Works Department as the First Party and the undersigned student at BRAC Institute of Governance and Development, BRAC University as the Second Party. The First Party has allowed the Second Party to prepare a report on Study of Supply Chain of Construction Materials During Post-Pandemic Period in public sector procurement for partial fulfillment of the requirements for the degree of Masters of Procurement and Supply Management. The Second Party will have the opportunity to work closely with the officials of the organization and have access to official data and information. Based on work experience, data, and information collected the Second Party will prepare a report. The Second Party will use all sorts of data and information for academic purposes and will not disclose to any party against the interests of the First Party.

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Acknowledgement

At first, I would like to express my sincere thankfulness to God for granting me the ability to successfully complete this project study.

I owe my supervisor a huge debt of appreciation and I'd like to express my heartfelt gratitude to my academic supervisor Shah Eyamin Ul Islam, Senior Trainer, BRAC Institute of Governance and Development (BIGD), BRAC University and workplace supervisor Abu Hayat Mohammad Shakiul Azam, Executive Engineer, Public Works Department for his unwavering support, generous assistance, constructive comments, and invaluable suggestions all through the work's progress.

I would really like to thank the officers and staff of BIGD, BRAC University, particularly Tanzina Mizan, Training Officer, BIGD, BRAC University, for her unwavering support throughout the study period.

I also would like to express my heartfelt gratitude to the respondents of different Public Sector Officials, notably Executive Engineers, Sub-divisional Engineers, and Assistant Engineers from various offices who assisted me at various phases of the data collection and provided numerous official support.

Finally, I'd like to thank my parents, wife and colleagues for their constant encouragement and support throughout the study.

Executive Summary

The COVID-19 pandemic caused major disruptions to global supply chains, including those for key construction materials. As the pandemic wanes and demand returns, the supply chain for materials like mild steel, cement and other materials faces lingering challenges that are slowing rebuilding efforts. Across all materials, depleted inventories, production limitations, and labor shortages continue hampering supply security and pricing power. Logistic delays and cost inflation are expected to hamper market stability through the near-term post-pandemic recovery. This strains rebuilding efforts and new construction initiatives.

This report analyzes supply and demand trends for these vital commodities, identifying constraints and dynamics that continue impacting availability and pricing during the post-pandemic recovery. Here post-pandemic scenario, focusing on the supply chain of construction materials is also described. The study encompasses an in-depth examination of the challenges faced, adaptations made and recommendations for a more resilient future. Though gradually rebalancing, deliberate strategies are imperative to stabilize construction materials supply chains.

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List of Acronyms

SCM	Supply Chain Management
PWD	Public Works Department
COVID-19	Coronavirus Disease 2019
ADP	Annual Development Plan
SC	Supply Chain
PM	Project Manager

Glossary

Resilience Strategies: Refer to methods, processes, or systems aimed at improving an entity's ability to positively adapt and recover when faced with adversity, shocks, or disturbances.

Intricate logistical Networks: Refer to a complex, interconnected system of organizations, people, activities, information, and resources involved in planning, implementing, and controlling the flow and storage of goods and services from point of origin to point of consumption.

Contingency Plan: It outlines alternative strategies, responses, and preparations to deploy if the primary plan of action is disrupted or becomes infeasible.

Dynamic Pricing Models: Refer to strategies and systems that allow companies to change the prices of goods or services in response to real-time market fluctuations, customer demand, and product availability.

Block Chain: It is a shared system for securely recording transactions end-to-end without centralized oversight - creating accountability while streamlining business operations.

Tier 1 Supplier: Means an direct supplier to procuring entity.

Carbon Footprint: It is a measure of the total amount of greenhouse gases, specifically carbon dioxide (CO₂) and other equivalent units of greenhouse gases.

LEED Certification: It is a rating systems measure green building performance across key areas like energy and water efficiency, waste management, pollution reduction and occupant health. Certification program is administered by the U.S. Green Building Council (USGBC).

BREEAM Certification: Certified buildings earn points across various categories to achieve ranked certification levels (Pass, Good, Very Good, Excellent, Outstanding) indicating sustainability leadership.

Chapter 1

Introduction

The global construction industry has long been recognized as a vital engine of economic growth and development. It encompasses a wide range of activities related to the planning, design, construction, and maintenance of structures and infrastructure. With the world's population continuing to grow and urbanize, the demand for construction projects remains robust.

The COVID-19 virus, caused by the SARS-CoV-2 virus, was first identified in Wuhan, China, in late 2019 and quickly spread globally. The World Health Organization (WHO) declared it a pandemic on March 11, 2020. The pandemic led to widespread illness, with millions of confirmed cases and deaths reported globally. Governments and health organizations implemented various measures such as lockdowns, social distancing, and mask mandates to control the spread. The pandemic triggered a global economic downturn, with disruptions in supply chains, decreased consumer spending, and increased unemployment.

However, the emergence of the COVID-19 pandemic marked an unprecedented challenge, shaking the foundations of supply chains worldwide. The construction material supply chain, in particular, faced significant disruptions, prompting a critical need for a comprehensive examination of the post-pandemic landscape.

This report aims to unravel the intricate dynamics of the supply chain for construction materials in the aftermath of the global health crisis. The COVID-19 pandemic, with its far-reaching implications, exposed vulnerabilities and inefficiencies in the traditional supply chain models. As the industry strives to recover and adapt to the new norms, a detailed understanding of the challenges encountered and the strategies employed is imperative for fostering resilience and sustainable growth.

1.1 Contextualizing the Impact of the Pandemic

The COVID-19 pandemic unleashed unprecedented disruptions across supply chains, as mandatory lockdowns and mobility restrictions stunted economic activities globally. Construction was no exception, as projects were halted and material supplies plunged in the initial months. As vaccination enables re-openings now, construction demand is recovering

rapidly. However, the magnitude of distress faced during peak pandemic continues to impair supply security - inventories were drained severely and logistics networks disrupted widely. At the same time, fiscal stimuli and infrastructure development commitments by governments are spurring construction. Thus, the combination of soaring demand and lingering supply bottlenecks is creating imbalance and volatility in construction material availability. The pandemic-induced supply shocks got amplified by external factors like weather and geopolitical conflicts too. These disruptions coupled with surging input and labour costs are inflating material prices and delaying project timelines. Therefore, despite recovering demand, pandemic-related setbacks continue to constrain the supply chain capabilities in meeting construction needs. Strategic measures from businesses and policy interventions by governments are vital to stabilize availability and affordability.

1.2 Objectives of the Study

In the wake of these unprecedented disruptions, this study seeks to achieve the following objectives:

Comprehensive Impact Assessment: Evaluate the multifaceted impact of the COVID-19 pandemic on the construction material supply chain, considering factors such as production, transportation, and labour dynamics.

Analysis of Adaptations and Innovations: Examine the adaptive measures and innovative strategies implemented by TIER-1 suppliers and procuring entity to navigate the challenges posed by the pandemic.

Identification of Resilience Strategies: Identify and analyse resilience-building strategies employed by companies to safeguard against future disruptions in the construction material supply chain.

The study aims to provide granular insights on pandemic recovery within construction value chain through evidence-based assessment of challenges faced and roadmap for strategic public-private actions needed. It offers constructive blueprint for all stakeholders to rebuild supply chain resilience for construction sector.

1.3 Significance of the Study

Understanding the post-pandemic supply chain dynamics is not merely an academic exercise but a crucial step toward fostering a robust and agile construction industry. Insights derived from this study are expected to inform industry players, policymakers, and other stakeholders, providing a foundation for informed decision-making and strategic planning.

1.4 Structure of the Report

This report is structured to provide a holistic view of the post-pandemic supply chain scenario for construction materials. Following this introduction, subsequent chapters will delve into the specific impacts of the pandemic, adaptations and innovations observed in the industry, questionnaire survey data analysis and a forward-looking analysis with recommendations for a resilient future.

As the construction industry embarks on a journey of recovery and transformation, this study aims to serve as a guiding beacon, illuminating the path toward a more resilient, sustainable, and adaptable construction material supply chain.

Chapter 2

Background Study

The construction industry has historically been a cornerstone of economic development, contributing significantly to infrastructure enhancement, urbanization, and employment generation. Prior to the emergence of the COVID-19 pandemic, the construction material supply chain operated within established frameworks, characterized by global interdependence, just-in-time practices, and intricate logistical networks. This chapter provides a retrospective analysis of the pre-pandemic construction material supply chain landscape, serving as a foundation for understanding the paradigm shift induced by the global health crisis.

2.1 Pre-Pandemic Supply Chain Dynamics

In the years preceding the COVID-19 outbreak, the construction material supply chain functioned in a globalized environment, with a complex web of interconnected suppliers, manufacturers, and distributors. International sourcing was commonplace, driven by considerations of cost efficiency and specialized expertise. Lean inventory management and just-in-time delivery models were embraced to optimize operational costs and enhance efficiency.

2.2 Global Interdependence:

The construction industry, being inherently global, relied on the seamless movement of materials across borders. International suppliers played a pivotal role in meeting the diverse and evolving demands of construction projects worldwide. This interdependence, while fostering economic efficiency, also exposed the supply chain to vulnerabilities associated with geopolitical events, natural disasters, and other external shocks.

2.3 Just-in-Time Practices

Efficiency was a key driver in the pre-pandemic construction material supply chain. Just-in-time practices, aimed at minimizing inventory carrying costs and maximizing responsiveness, became prevalent. However, this efficiency-oriented approach left the supply chain susceptible to disruptions, as witnessed during the COVID-19 pandemic. Some examples of JIT practices in construction sectors are using ready mix concrete for casting, precast concrete panels, wall sections, or entire modules for buildings.

2.4 Logistical Networks

The seamless flow of construction materials relied heavily on intricate logistical networks. From raw material extraction to manufacturing, transportation, and delivery to construction sites, each stage was intricately linked. These networks were optimized for speed and cost-effectiveness, but the rigid structures were challenged when faced with unforeseen disruptions.

2.5 Emerging Trends

Before the pandemic, the industry had already begun witnessing trends indicative of changing dynamics. Increasing digitalization, emphasis on sustainability, and a growing awareness of supply chain risks were emerging as focal points for future consideration. The pandemic, however, acted as a catalyst, accelerating the adoption of these trends and necessitating a reevaluation of existing practices.

2.6 Vulnerabilities Exposed by the Pandemic

The onset of the COVID-19 pandemic laid bare the vulnerabilities inherent in the traditional construction material supply chain. The disruption of global transportation, labor shortages, and unforeseen demand fluctuations highlighted the need for a more adaptive and resilient supply chain architecture.

As we delve deeper into the post-pandemic era, the insights garnered from this retrospective analysis will serve as a crucial reference point. The construction material supply chain, having weathered the storm of the pandemic, is now poised for transformation. This background chapter sets the stage for a comprehensive exploration of the industry's journey towards resilience, innovation, and adaptability in the face of unprecedented challenges.

Chapter 3

Methodology and Data Collection

The questionnaire survey is a crucial research tool designed to gather firsthand insights and perspectives from key stakeholders in the construction industry regarding the supply chain dynamics of construction materials during the post-pandemic period. This approach was used as the primary method for producing the report's conclusions. A questionnaire is a list of questions distributed to research project participants. It may be a part of a bigger investigation. The goal of a questionnaire is to gather data from a target audience. To collect information from diverse respondents who work at different PWD offices, a series of questionnaires was created. Numerous sorts of questions are included in the questionnaire about the supply chain of construction materials in post pandemic period for generating result.



Figure 1: Flow Chart of Methodology

The questionnaire survey will generate crucial primary inputs from supply chain entities around areas of concern and ongoing challenges. This will help to shape policy and necessary interventions needed for strengthening the post-pandemic construction materials supply chain.

3.1 Approach of Conducting Survey

The approach to conducting this survey involves several key steps to ensure relevance, accuracy, and completeness of the data collected.

1. Defining Objectives:

Clearly articulate the objectives of the survey, specifying the information needed to address the research questions outlined in the study.

2. Target Audience Identification:

Identify and define the target audience for the survey, ensuring representation from various roles within the construction industry such as suppliers, manufacturers, distributors, contractors, and other relevant stakeholders.

3. Question Design:

Develop a set of clear, concise, and relevant questions that align with the research objectives. Questions should cover a range of topics, including the impact of the pandemic, adaptations and innovations, resilience strategies, and future outlook.

4. Structuring the Questionnaire:

Organize the questionnaire into logical sections, starting with demographic information, followed by questions related to the impact of the pandemic, adaptations and innovations, resilience strategies, and future outlook.

5. Mix of Question Types:

Include a mix of question types, such as multiple-choice, open-ended, and Likert scale questions, to gather both quantitative and qualitative data. This ensures a comprehensive understanding of respondents' experiences and opinions.

3.2 Questionnaire Design

Our goal is to find out the situation of supply chain during post pandemic period and find out the challenges with solution.

The questionnaire is designed to build an in-depth understanding across four key dimensions of the current pandemic recovery being faced within construction material supply chains globally. This includes:

Material Demand: The first section would assess demand rebound for major materials like cement, steel, copper wiring and lumber by monitoring orders/revenue levels on a quarterly basis since 2020. Comparing with pre-pandemic levels and future projections will indicate the extent of demand resurgence.

Supply Capability: This crucial section would map existing production issues that constrain supply response. Questions would cover operational metrics like capacity utilization rates, raw material availability, workforce availability, and inventory levels. Pandemic versus current figures provide supply deficit context.

Transportation & Logistics: Questions in this section evaluate lead times, freight costs and bottlenecks across stages - supplier to producer, inter plant, warehouse to site transfers.

Comparing time and cost metrics during peak pandemic, currently and future forecasts highlights logistic roadblocks limiting supply chain efficiency.

Cost Drivers: Last section deep dives into input costs like power, fuel, labour and evaluates product pricing impacts - price levels, revisions frequency etc. This highlights cost pressures determining build-up volatility in procurement costs.

Comparing these facets historically and with future outlooks will help identify critical vulnerabilities and constraints in the construction supply chain presently. This also informs targeted, effectual interventions needed - whether policy, investments or collaborations across companies.

3.3 Selection of Target Group for Survey Data Collection

The questionnaire was sent to a selected group of public sector construction officials, ranging in position from Assistant Engineer to Executive Engineer, who actively participate in the organization's procurement and supply chain procedures. Public sector's continuing development initiatives in Bangladesh were emphasized, especially those that were in the process of being carried out. A few ongoing projects during pandemic period were also considered for gathering data. Questions were sent on their email for their spontaneous response.

3.4 Procedure of Data Collection

Conducting a questionnaire survey involves careful planning and execution to ensure reliable and meaningful data collection. The study's data is acquired in such a way that the results accurately represent the situation as it actually is. The questionnaire survey was carried out on three part. First part for cement supply chain, second part for mild steel and third part for electrical cable. The respondents included Assistant Engineers, Sub Divisional Engineers and Executive Engineers of public sector construction officials who were involved in various field divisions and related to the entire procurement functions of their offices. The questionnaire was sent on email and respectfully asked to respond to the survey based on their knowledge of the activities that were handled under their authority. The analysis and integration of the acquired survey data were merged in order to find the supply chain disruption and to find the solution of these disruptions.

Chapter 4

Data Analysis, Findings & Result

In this chapter we will analyze the data collected from questionnaire. There are four set of questionnaire where three questionnaires was related to supply chain disruption of cement, mild steel & electrical cable supply and the other was not what can be done to find the solution of those disruptions. Present the data that was collected and analyzed in an organized and logical manner: The raw data is processed, organized into tables, charts, graphs, and summarized to highlight useful insights and trends. The most important findings obtained from the data analysis are highlighted and explained.

4.1 Supply Chain Disruption of Raw Materials

The COVID-19 pandemic has had a significant impact on global supply chains, including those in the construction industry. Lockdowns and restrictions in various countries led to the closure of manufacturing facilities. This affected the production of key construction materials such as steel, cement, and other building components.

In our survey of cement supply chain most respondents (92.3%) experienced disruptions in raw material supply for cement production during the pandemic. 100% of respondents experienced disruptions in raw material supply for mild steel production during the pandemic. 93.8% faced disruptions in raw material supply for electrical cable production. This indicates severe and universal supply issues. The survey data are shown in pie chart.

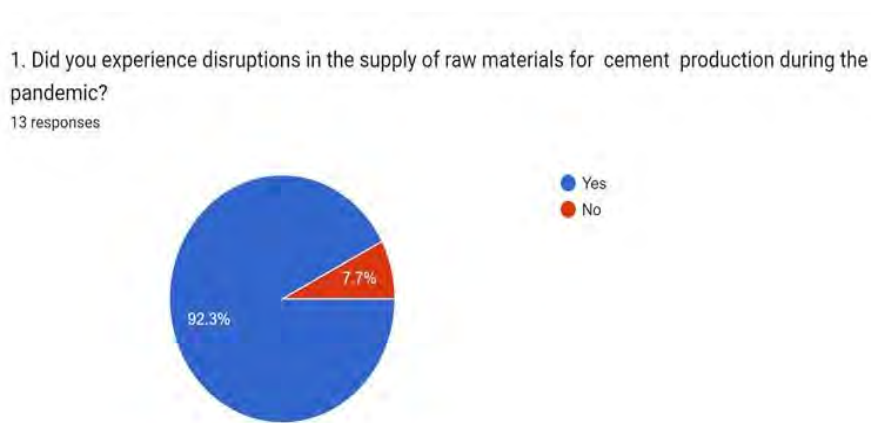


Figure 2: Supply disruption of cement

1. Did you experience disruptions in the supply of raw materials for mild steel production during the pandemic?
17 responses

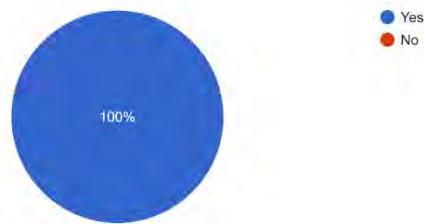


Figure 3: Supply disruption of mild steel

1. Did you experience disruptions in the supply of raw materials for electrical cable production during the pandemic?
16 responses

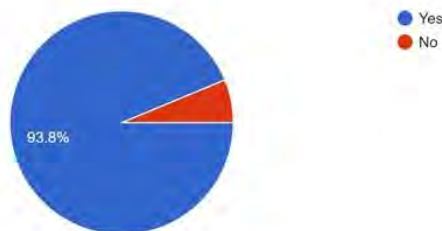


Figure 4: Supply disruption of electrical cable

4.2 Major Challenges Faced by TIER-I Suppliers

Tier-I suppliers in the construction sector faced several challenges during the pandemic period. Interruptions in the supply chain due to lockdowns, restrictions on movement, and closures of manufacturing facilities led to delays in the delivery of construction materials. Social distancing measures and lockdowns resulted in a shortage of skilled and unskilled labor. Construction projects were impacted by the inability to maintain regular staffing levels, leading to delays and increased costs. Many construction projects were delayed or postponed as a result of government-imposed restrictions, financial uncertainties, and concerns about worker safety. This led to financial losses for Tier-I suppliers. Compliance with new health and safety protocols, additional safety measures, and the need for remote work solutions increased operational costs for Tier-I suppliers.

In our survey of cement supply chain respondents viewed COVID impact on supply chains and operations as moderate (50%) to severe (25%). This indicates significant ongoing supply chain disruption due to the pandemic in the construction industry. In case of cement supply Major challenges faced included volatile pricing (53.8%), unexpected delays (46.2%), increasing

freight costs (30.8%), and difficulty with demand forecasting (23.1%). This points to pricing volatility, logistics delays, and planning difficulties. For mild steel supply chain survey major challenges were unexpected delays (52.9%), volatile prices (58.8%), increasing freight costs (58.8%), and demand forecasting problems (17.6%). This indicates pervasive uncertainty and cost pressures. In case of electrical cable supply the most cited challenges were unexpected delays (56.3%), volatile pricing (50%), and increasing freight costs (18.8%). This points to logistics disruptions, cost inflation, and demand-supply mismatches.

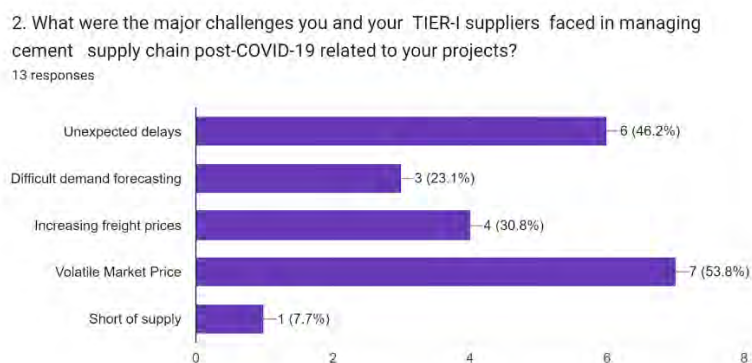


Figure 5: Major Challenges faced by TIER-I Suppliers (Cement Supply)

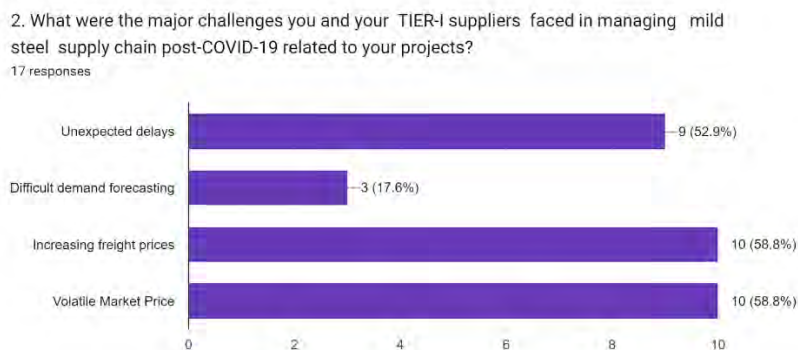


Figure 6: Major Challenges faced by TIER-I Suppliers (Mild Steel Supply)

2. What were the major challenges you and your TIER-I suppliers faced in managing electrical cable supply chain post-COVID-19 related to your projects?
16 responses

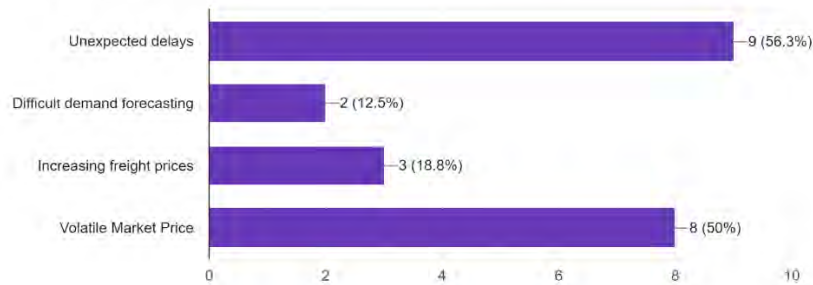


Figure 7: Major Challenges faced by TIER-I Suppliers (Electrical Cable Supply)

4.3 Nature and Extent of Disruption in Supply Chain

The COVID-19 pandemic had a profound impact on the supply chain for construction raw materials, leading to disruptions of varying nature and extent. Construction industries often rely on a global supply chain for raw materials. The pandemic triggered disruptions at an international level, affecting the import and export of construction materials. Delays in shipments and increased lead times were common. The construction supply chain is often complex, involving multiple intermediaries and stages. Disruptions at any point in the supply chain could have a cascading effect, impacting the availability of raw materials for construction projects.

In our survey data for cement supply chain 53.8% said the disruptions were moderate, while 30.8% said severe. So disruptions were significant for most respondents. In mild steel survey 47.1% said supply chain disruptions were moderate, while 35.3% said severe. In electrical cable supply chain survey 50% said supply chain disruptions were moderate. So we can say disruptions were notable for most of the respondents.

3. What is the nature and extent of disruptions in supply chain of cement in pandemic period?
13 responses

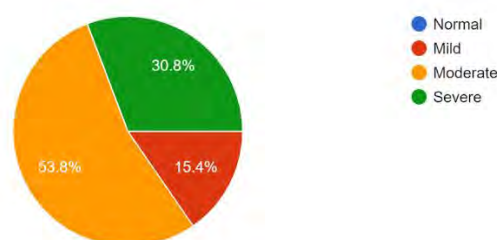


Figure 8: Nature and Extent of disruption in Supply Chain (Cement Supply)

3. What is the nature and extent of disruptions in supply chain of mild steel in pandemic period?
17 responses

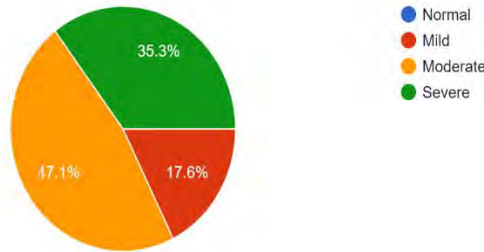


Figure 9: Nature and Extent of disruption in Supply Chain (Mild Steel Supply)

3. What is the nature and extent of disruptions in supply chain of electrical cable in pandemic period?
16 responses

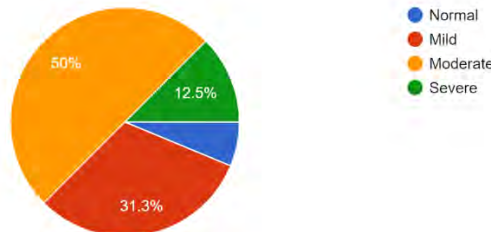


Figure 10: Nature and Extent of disruption in Supply Chain (Electrical Cable Supply)

4.3 Effects on Ability of TIER-I Suppliers to Meet the Purchase Requirement During Pandemic Period

The ability of TIER-I suppliers to meet purchase requirements for construction materials during a pandemic period can be influenced by various factors. The impact can vary based on the severity of the pandemic, government regulations, supply chain disruptions, and the specific characteristics of the of the construction industry. Economic downturns associated with pandemics can result in financial challenges for TIER-I suppliers. Suppliers may face difficulties in securing funds for operations, raw materials, or investments, impacting their ability to meet purchase requirements. Construction activity may decline during a pandemic due to project delays, cancellations, or economic uncertainties.

The survey result indicates that incase of cement supply chain 69.2% said supplier ability to meet purchase requirements was affected via project delays or pauses. Whereas the percentage

for mild steel supply is 58.8% and electrical cable supply is 68.8%. This confirms major supplier issues. This mean project implementers face financial challenges during a pandemic, affecting their ability to proceed with construction projects.

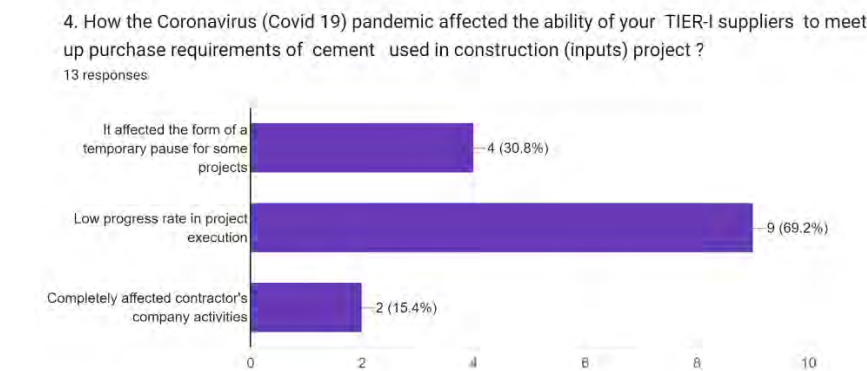


Figure 11: Effects on the ability of TIER-I suppliers (Cement Suppliers)

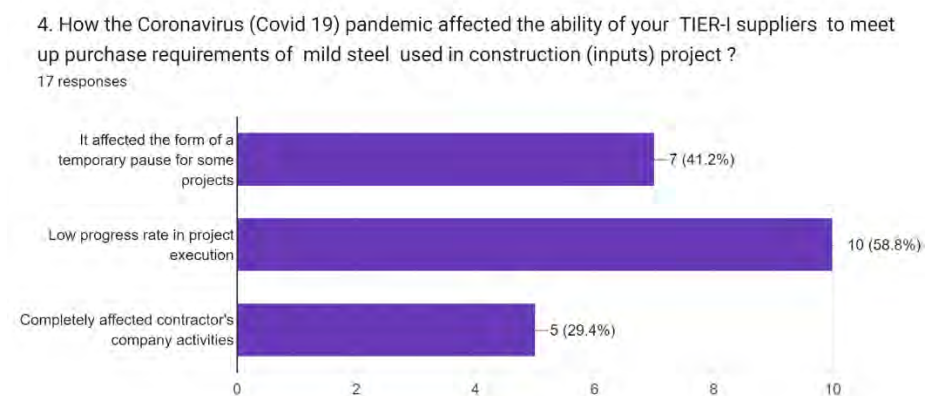


Figure 12: Effects on the ability of TIER-I suppliers (Mild Steel Suppliers)

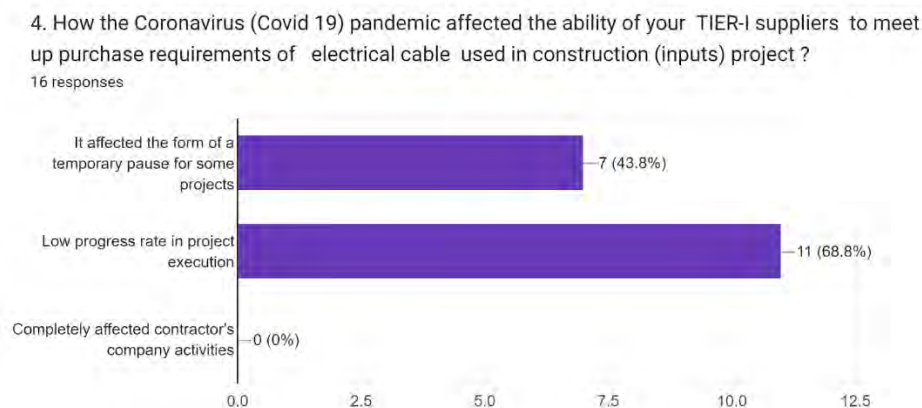


Figure 13: Effects on the ability of TIER-I suppliers (Electrical Cable Suppliers)

4.4 Most Impacted Areas of Supply Chain

The post-pandemic period can continue to pose challenges to the supply chain of construction materials. While the specific impact areas can vary depending on factors such as the severity of Continuing challenges in logistics and transportation, including increased costs, shortages of shipping containers, and delays in transit, can impact the timely delivery of construction materials. During the pandemic local regulations, and the resilience of individual supply chains, several common areas are often affected. Delays or disruptions in the extraction or production of raw materials can affect the availability of key components in the construction materials supply chain.

In our survey of cement supply the most impacted supply chain areas were planning & sourcing of raw materials (cited by 53.8%), logistics & distribution (46.2%), and production (30.8%). For mild steel survey most impacted supply chain areas were planning & sourcing of raw materials (58.8%) and production (35.3%) whereas in case of electrical cable supply most impacted supply chain areas were planning & sourcing of raw materials (31.3%) and production (43.8%). So early supply chain stages were hit hardest.

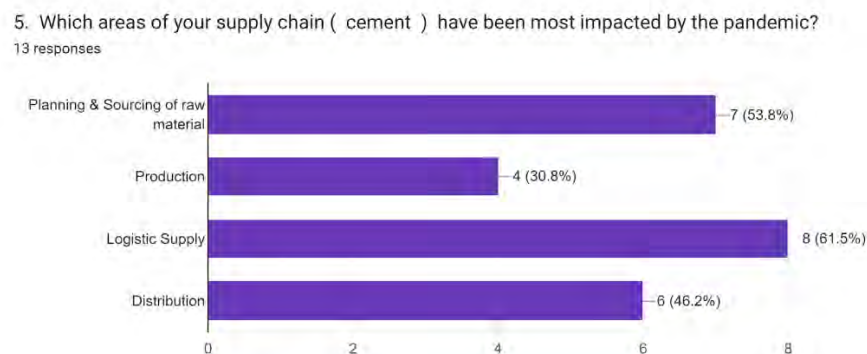


Figure 14: Impacted areas of cement supply chain

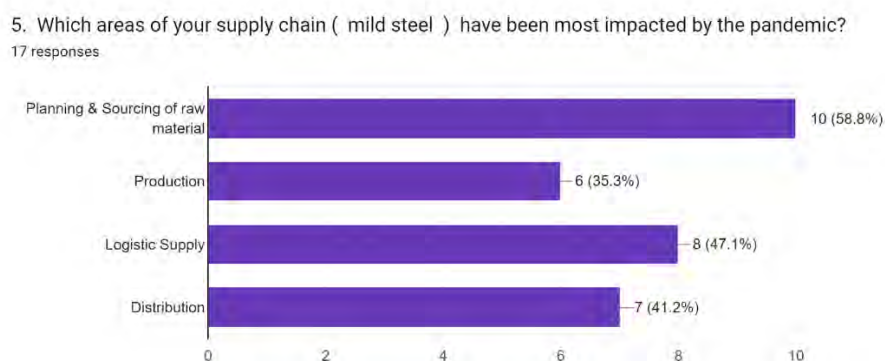


Figure 15: Impacted areas of mild steel supply chain

5. Which areas of your supply chain (electrical cable) have been most impacted by the pandemic?
16 responses

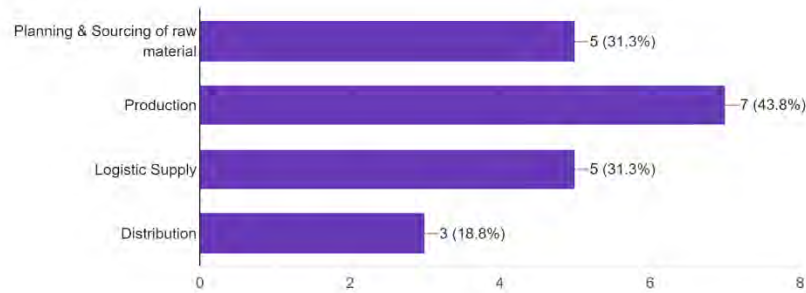


Figure 16: Impacted areas of mild electrical cable supply chain

4.6 Effect of Price Hike on Supply Chain

A price hike in the construction material supply chain during the post-pandemic period can have several significant effects on various aspects of the supply chain. A price hike in raw materials, such as metals, cement, or timber, can increase the overall cost of production for construction materials. Suppliers may face challenges in maintaining profit margins if the cost of inputs rises significantly. A significant price hike in construction materials can lead to reduced demand, as construction projects may be delayed or scaled down due to increased costs. This can have a cascading effect on the entire supply chain.

In our survey 46.2% said price hikes for cement were moderate, while 30.8% said severe. So cement costs were a notable issue. 52.9% said mild steel price hikes were moderate, while 17.6% said mild. So volatile pricing was a major concern for mild steel supply chain. 50% said cable price hikes were moderate. Pricing instability was a major concern.

6. Construction materials have seen fluctuating prices throughout the COVID-19 pandemic. The global demand for cement coupled with a strained ... world (Price Hikes) . What is the extent of this?
13 responses

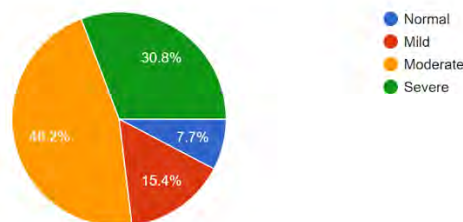


Figure 17: Extent of Price hike on Cement Supply Chain

6. Construction materials have seen fluctuating prices throughout the COVID-19 pandemic. The global demand for mild steel coupled with a strained world (Price Hikes) . What is the extent of this?
17 responses

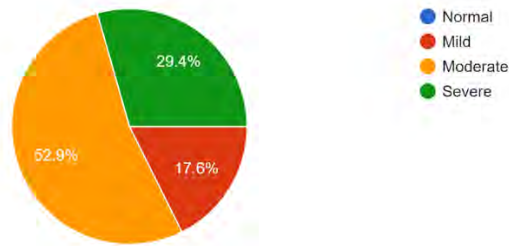


Figure 18: Extent of Price hike on mild steel Supply Chain

6. Construction materials have seen fluctuating prices throughout the COVID-19 pandemic. The global demand for electrical cable coupled with a ...D world (Price Hikes) . What is the extent of this?
16 responses

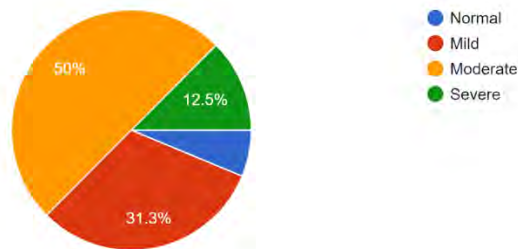


Figure 19: Extent of Price hike on electrical cable Supply Chain

4.7 Mitigation of Supply Risk by TIER-I Suppliers

Mitigating supply chain risks for TIER-I suppliers of construction materials in the post-pandemic period involves strategic planning, collaboration, and the implementation of robust risk management practices. Diversification of Suppliers, Supply Chain Visibility, Risk Assessment and Contingency Planning, Collaboration and Communication, Strategic Stockpiling, Agile Manufacturing and Production, Scenario Planning and Technology Adoption are key strategies that suppliers can consider.

In our survey 53.8% said their suppliers managed inventory to mitigate risks for cement, 64.7% said their suppliers managed inventory to mitigate risks for mild steel and 50% said their suppliers managed inventory to mitigate risks for electrical cable.

7. Did your TIER-I suppliers manage inventory during the post-COVID-19 period to mitigate supply chain risks of cement ?
13 responses

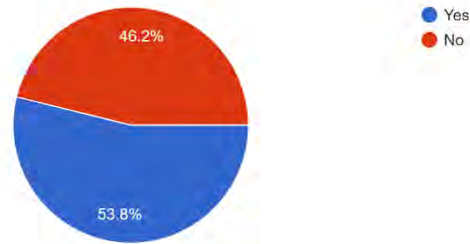


Figure 20: Mitigation of supply chain risk by inventory management (Cement Supply)

7. Did your TIER-I suppliers manage inventory during the post-COVID-19 period to mitigate supply chain risks of mild steel ?
17 responses

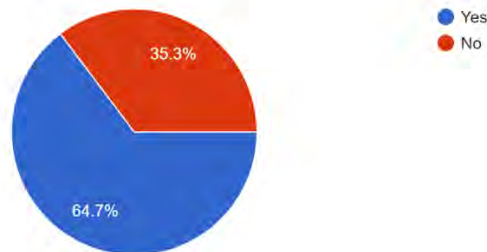


Figure 21: Mitigation of supply chain risk by inventory management (Mild Steel Supply)

7. Did your TIER-I suppliers manage inventory during the post-COVID-19 period to mitigate supply chain risks of electrical cable ?
16 responses

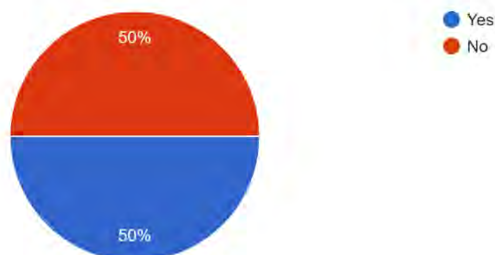


Figure 22: Mitigation of supply chain risk by inventory management (Electrical Cable Supply)

4.8 Alternative Supplier Exploration to Mitigate Supply Chain Risk

Exploring alternative suppliers is a crucial strategy for mitigating supply chain risks for construction materials in the post-pandemic period. This approach helps reduce dependency on a single source and provides flexibility to adapt to changing market conditions. Evaluation of potential suppliers based on their financial stability, production capacity, quality standards, and track record is necessary to mitigate the risk.

In our survey for cement supply chain 46.2% explored new suppliers to mitigate risks whereas the percent is 53.8% for mild steel and 75% for electrical cable supply chain. So we can say most of the suppliers tried to explore new suppliers or diversify its supplier base to mitigate supply chain risk.

8. Did your TIER-I suppliers explore new suppliers or diversify its supplier base to mitigate supply chain risks of cement after the pandemic?
13 responses

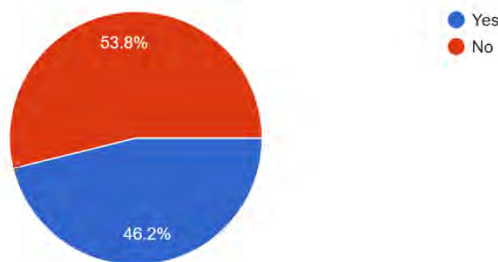


Figure 23: Alternative Supplier exploration (Cement Suppliers)

8. Did your TIER-I suppliers explore new suppliers or diversify its supplier base to mitigate supply chain risks of mild steel after the pandemic?
17 responses

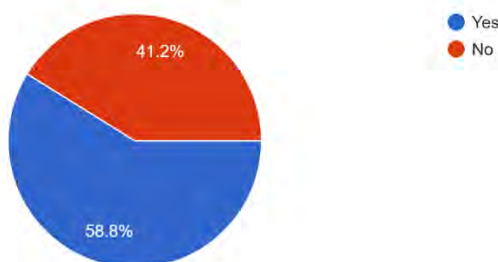


Figure 24: Alternative Supplier exploration (Mild Steel Suppliers)

8. Did your TIER-I suppliers explore new suppliers or diversify its supplier base to mitigate supply chain risks of electrical cable after the pandemic?
16 responses

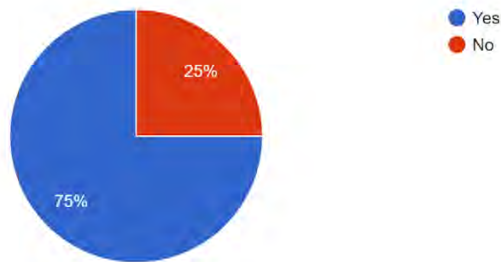


Figure 25: Alternative Supplier exploration (Electrical Cable Suppliers)

4.9 Effect of Shipping Cost Increase on Supply Chain of Raw Materials

An increase in shipping costs can have significant implications for the supply chain of raw materials used in the construction materials industry during the post-pandemic period. Higher shipping costs contribute to an overall increase in production costs for construction material manufacturers, particularly those reliant on imported raw materials. This can impact profit margins and potentially lead to price increases for finished products.

In our survey of cement supply chain 38.5% said increased shipping costs moderately impacted supply chains, indicating freight was a disruptor. For mild steel 64.7% said shipping cost rises moderately impacted supply chains and for electrical cable 56.3% said shipping cost rises moderately impacted chains.

9. There has been a steep rise in shipping costs at an international level, partly caused by a shortage of containers, a problem related to COVID...this reason hampered the supply chain of cement?
13 responses

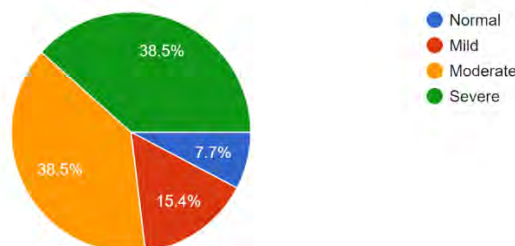


Figure 26: Effect of Shipping Cost Increase on Supply Chain of Cement

9. There has been a steep rise in shipping costs at an international level, partly caused by a shortage of containers, a problem related to COVID-...eason hampered the supply chain of mild steel ?
17 responses

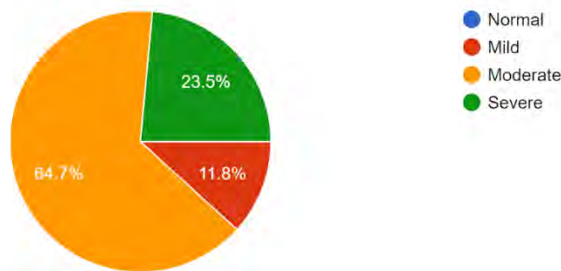


Figure 27: Effect of Shipping Cost Increase on Supply Chain of Mild Steel

9. There has been a steep rise in shipping costs at an international level, partly caused by a shortage of containers, a problem related to COVID-r... hampered the supply chain of electrical cable ?
16 responses

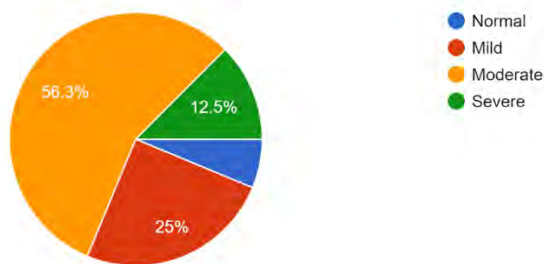


Figure 28: Effect of Shipping Cost Increase on Supply Chain of Electrical Cable

4.10 Measures taken to mitigate Supply Chain Shortage

Mitigating supply chain shortages for construction materials in the post-pandemic period requires a comprehensive and strategic approach. Actively seek and qualify additional suppliers for critical construction materials. Diversifying the supplier base can reduce dependence on a single source and enhance supply chain resilience. Consider both local and global suppliers to balance risk factors. Local suppliers may provide faster response times, while global suppliers offer diversification and potential cost advantages.

In our survey of cement, mild steel and electrical cable supply chain sequentially 76.9%, 58.8% and 68.8% respondents revised their site work programme. While 46.2% for cement, 41.2% for mild steel and 25% for electrical cable supply related respondents have to temporarily shut down their project due to supply chain shortage.

10. What type measures taken at construction site to improve the progress rate in Covid Period due supply shortage of cement ?

13 responses



Figure 29: Measures taken to mitigate Supply Chain Shortage (Cement Supply)

10. What type measures taken at construction site to improve the progress rate in Covid Period due supply shortage of mild steel ?

17 responses

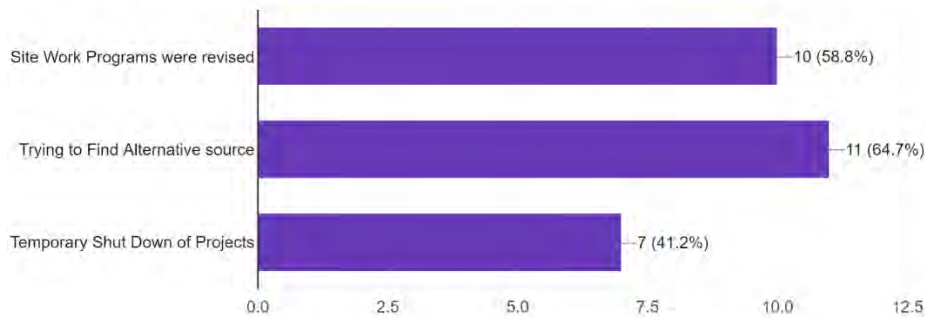


Figure 30: Measures taken to mitigate Supply Chain Shortage (Mild Steel Supply)

10. What type measures taken at construction site to improve the progress rate in Covid Period due supply shortage of electrical cable ?

16 responses

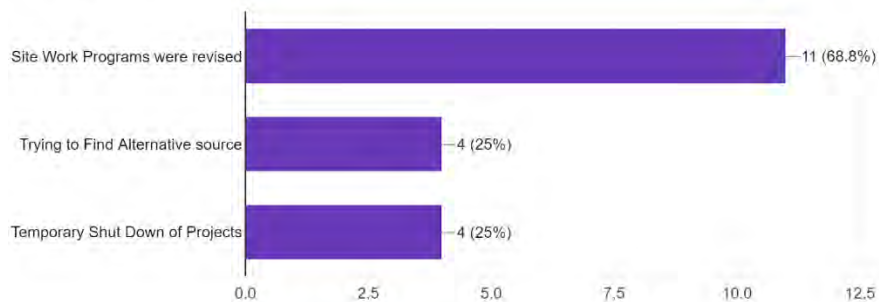


Figure 31: Measures taken to mitigate Supply Chain Shortage (Electrical Cable Supply)

4.11 Contingency Plan to Manage Supply Chain Disruptions

Developing a contingency plan to manage supply chain disruptions in the post-pandemic period is crucial to ensure business continuity and resilience. Risk assessment, Supplier management, Inventory management, Logistics & transportation mode diversification are comprehensive guide to develop an effective plan.

In our survey most respondents indicated that their Tier-1 suppliers have implemented resilience plans to manage supply chain disruptions, with the top two strategies being:

Identifying alternate local suppliers (for cement supply chain 76.9% respondents, for mild steel its is 47.1% and for electrical cable it is 62.5%).

Creating backup systems to control the volatile market (for cement supply chain 61.5% respondents, for mild steel it is 52.9% and for electrical cable it is 12.5%).

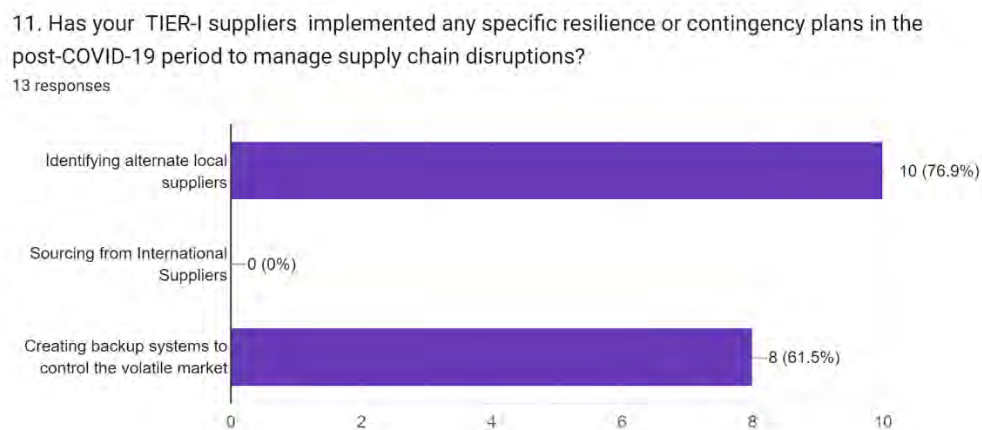


Figure 32: Contingency Plan to Manage Supply Chain Disruptions (Cement Supply)

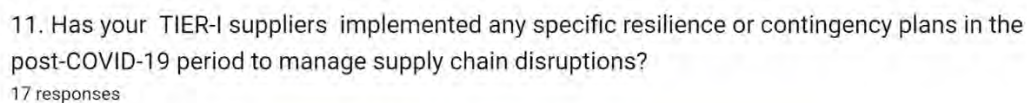


Figure 33: Contingency Plan to Manage Supply Chain Disruptions (Mild Steel Supply)

11. Has your TIER-I suppliers implemented any specific resilience or contingency plans in the post-COVID-19 period to manage supply chain disruptions?
16 responses

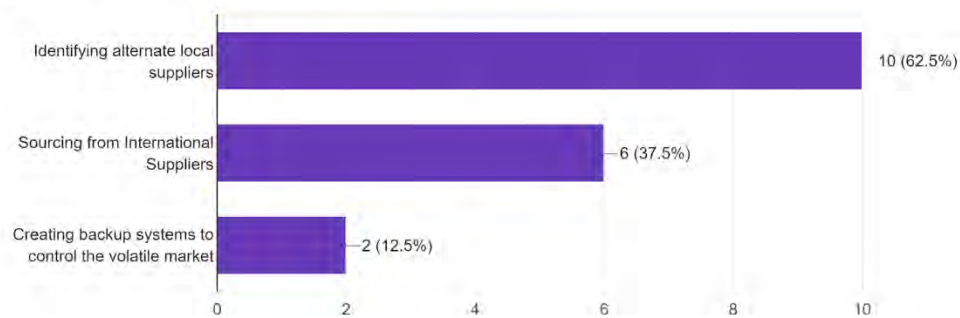


Figure 34: Contingency Plan to Manage Supply Chain Disruptions (Electrical Cable Supply)

4.12 Collaboration with Suppliers, Distributors and Other Stakeholders to Ensure a More Resilient Supply Chain

In the post-pandemic period, collaboration with suppliers, distributors, and other stakeholders is crucial for establishing and maintaining a resilient supply chain for construction materials. This collaborative effort involves a series of strategic initiatives aimed at mitigating risks, improving communication, and enhancing overall supply chain efficiency. Engage in a comprehensive analysis of potential risks within the supply chain. Work closely with suppliers and distributors to identify vulnerabilities and develop proactive strategies to mitigate these risks. Establish an open and transparent line of communication with all stakeholders. This involves regular and candid exchanges of information regarding market conditions, demand fluctuations, and any potential challenges.

In our survey of cement supply chain key ways to improve future resilience were aligning with suppliers (76.9%), and fostering supplier relationships (46%). This suggests a partnership strategy. For mild steel supply chain the top ways to improve resilience were aligning with partners (76.5%), and enhancing inventory/distribution (5.9%). This indicates a flexibility strategy. In electrical cable supply chain survey 62.5% planned more supply chain collaboration. So here partnership is seen as key for resilience.

12.How does your TIER-I suppliers plan to collaborate with suppliers, distributors, and other stakeholders to ensure a more resilient cement supply chain in the future?

13 responses

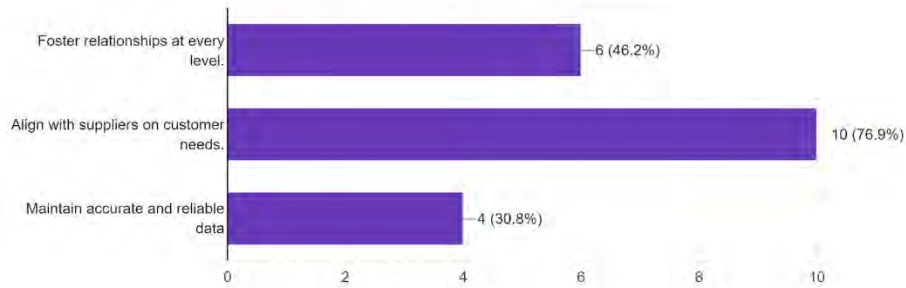


Figure 35: Collaboration with suppliers, distributors, and other stakeholders (Cement Supply)

12.How does your TIER-I suppliers plan to collaborate with suppliers, distributors, and other stakeholders to ensure a more resilient mild steel supply chain in the future?

17 responses

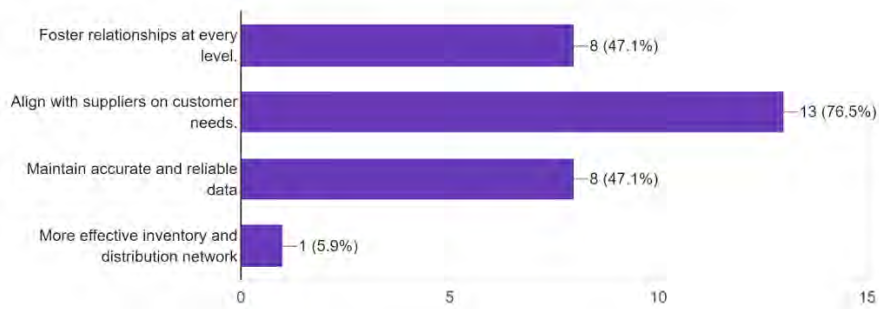


Figure 36: Collaboration with suppliers, distributors, and other stakeholders (Mild Steel Supply)

12.How does your TIER-I suppliers plan to collaborate with suppliers, distributors, and other stakeholders to ensure a more resilient electrical cable supply chain in the future?

16 responses

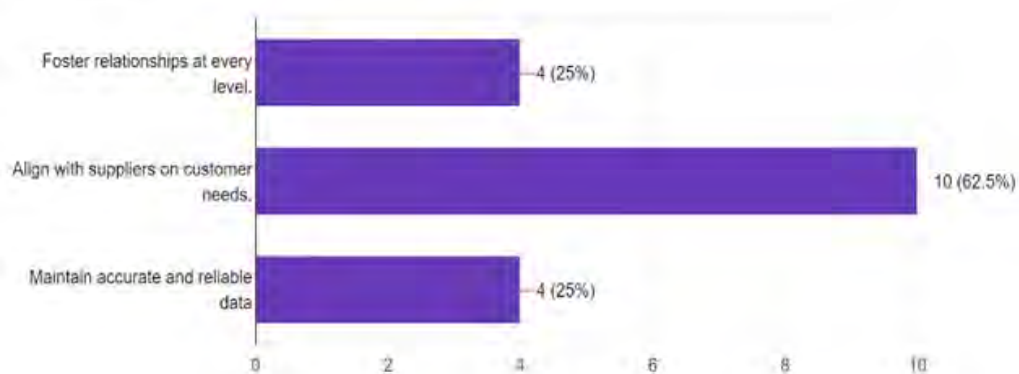


Figure 37: Collaboration with suppliers, distributors, and other stakeholders (Electrical Cable Supply)

4.13 Experience Based Suggestion for Improving the Supply Chain

Improving the supply chain for construction materials in the post-pandemic period requires practical, experience-based suggestions. Relying on a single supplier can lead to vulnerabilities. Based on past disruptions, consider diversifying your supplier base geographically and across different suppliers. Establish regular communication channels with suppliers, distributors, and other stakeholders. Use collaborative platforms for real-time updates and discussions.

From our survey of cement SC top suggestions for improving supply chains included alternative materials sourcing (69.2%) and research & development (61.5%). So redundancy and innovation are advised. For mild steel SC major suggestions were R&D (64.7%) and optimizing inventory (52.9%). So innovation and buffering are advised. And for electrical cable SC finding alternative materials sources (75%) was the top suggestion.

13. Based on your experience, what suggestions do you have for improving the cement supply chain in the post-pandemic period?
13 responses

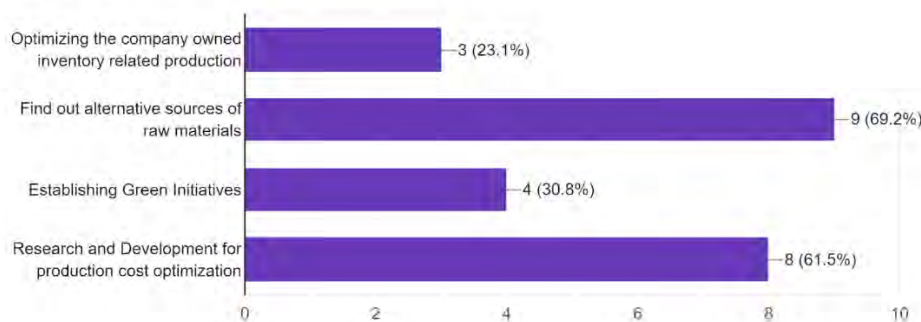


Figure 38: Suggestion for Improving the Supply Chain of Cement

13. Based on your experience, what suggestions do you have for improving the mild steel supply chain in the post-pandemic period?
17 responses

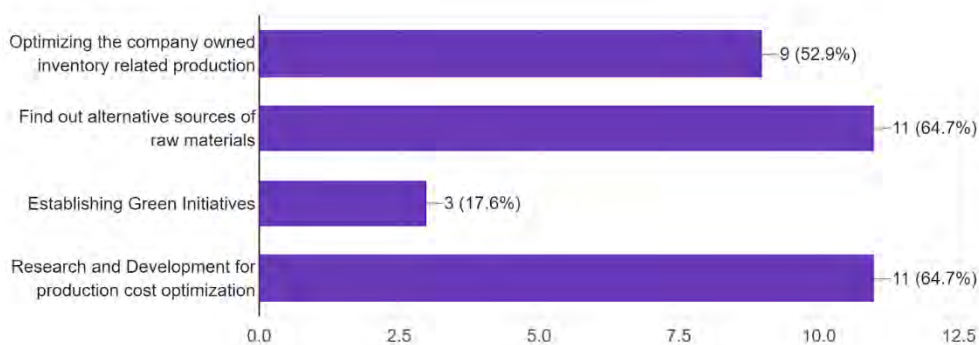


Figure 39: Suggestion for Improving the Supply Chain of mild steel

13. Based on your experience, what suggestions do you have for improving the electrical cable supply chain in the post-pandemic period?

16 responses

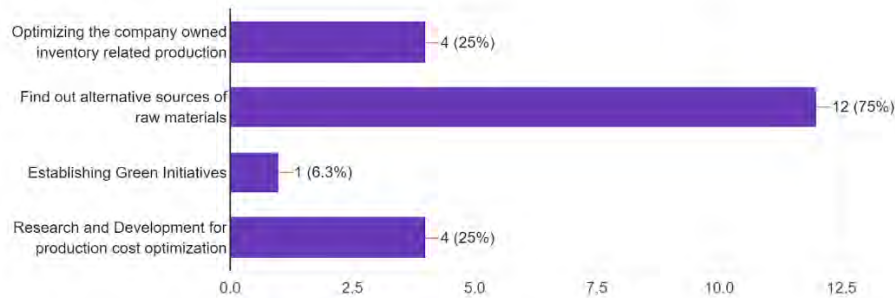


Figure 40: Suggestion for Improving the Supply Chain of electrical cable

4.14 Finding Solution of disruption of Supply Chain of Construction Materials on Post Pandemic Period

4.14.1 Early Selection of Price Fluctuation Matters in Contract

Addressing the early selection of price fluctuation in a contract and finding solutions for disruptions in the supply chain of construction materials post-pandemic requires a strategic and comprehensive approach. Consider fixed-price contracts for greater cost predictability and also include provisions for adjustments in case of unforeseen circumstances like extreme market fluctuations.

In our survey Majority (8 out of 10) respondents agreed that identifying substitute materials upfront is beneficial to mitigate supply chain risks. This allows more flexibility in material selection.

1. Prior to entering into a construction contract, if parties identify that certain materials selected may be difficult to obtain or subject to price fluctu...hly consider if those materials could be substituted.

10 responses

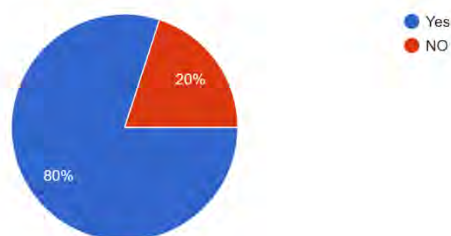


Figure 41: Early selection of price fluctuation matters in a contract

4.14.2 Pandemic Management Plan

COVID management plans help contractors maintain operations amidst uncertainty. They stipulate policies around health & safety, workforce continuity, supply chain impacts etc. This brings clarity and helps smooth project execution.

In our survey most (70% to 90%) rated the impact of COVID management plans on projects and supply chain as moderate to severe. This suggests these plans are seen as helpful for navigating pandemic uncertainties.

2. During or After the pandemic, it has become a common requirement for contractors to prepare a COVID management plan which sets out how the contractor will manage the projects and supply chain materials.
10 responses

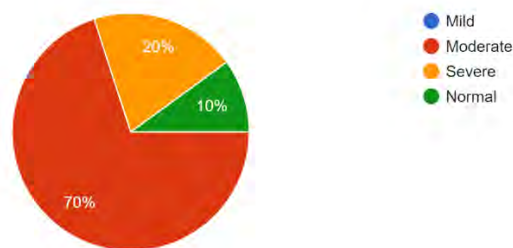


Figure 42: Pandemic Management Plan

4.14.3 Risk Sharing Provisions Between Contractor & Procurement Manager

Including supply chain risk sharing provisions allows for better handling of uncertain events. Rather than one party bearing all the risk/impact, it is shared appropriately between contractor and client. This facilitates timely completion.

In our survey 50% to 70% respondents felt that including supply chain risk sharing contract provisions can enable timely project completion to a moderate or severe extent. This highlights the value of balanced risk allocation.

3. Impact of including supply chain provisions (Sharing risk of uncertain times mean that this risk is more appropriately shared between the parties – Co...completion & consistency of supply of materials .
10 responses

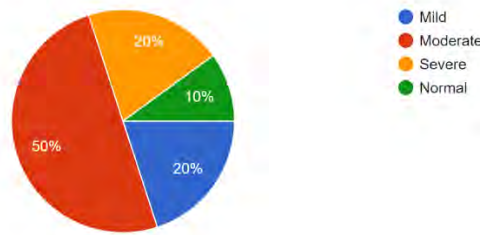


Figure 43: Risk sharing provisions between Contractor & Procurement Manager

4.14.4 Controlling Rise and Fall for Specified Materials

To control price rises for materials, fixed price contracts and price adjustment clauses can be useful. The former sets an agreed ceiling, while the latter allows calibrated changes tied to understood market indexes.

In our survey 70% of the respondents agreed price adjustment under certain scenario should be made to control rise and fall for specified materials in market.

4. How Rise and fall for specified materials can be controlled ?
10 responses

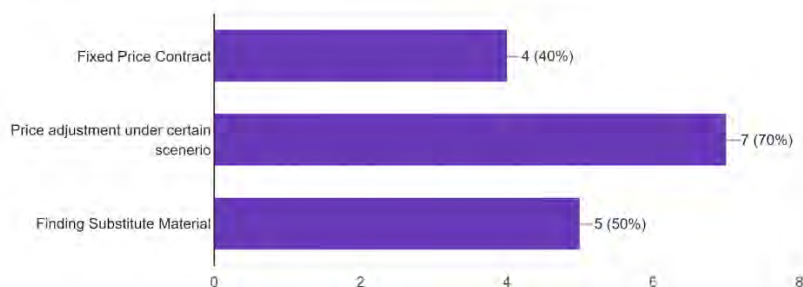


Figure 44: Controlling Rise and fall for specified materials

4.14.5 Provision for Price Adjustment in Schedule of Rates

Introducing dynamic pricing adjustment in standard public works rate schedules creates scope to track market volatility. This way pre-defined rates don't become outdated. 100% respondents agreed that introducing price adjustment provisions can help control supply and prices of materials. This indicates acceptance towards dynamic pricing models.

5. Introducing provision for price adjustment in PWD Schedules of Rates may help to control the supply of materials.
10 responses



Figure 45: Provision for price adjustment in Schedule of Rates

4.14.6 Concerned Govt. Agencies regular monitoring to control the price volatility & quality of construction materials

Government agencies monitoring prices and supply availability can help detect issues early. This allows timely interventions to control unwarranted price hikes and low quality goods in the market.

In our survey 30% to 70% of respondents thinks Government agencies monitoring can have moderate to severe effect to control the price volatility & quality of construction materials.

6. Concerned Govt. Agencies regular monitoring can control the price volatility & quality of construction materials . What will be the impact?
10 responses

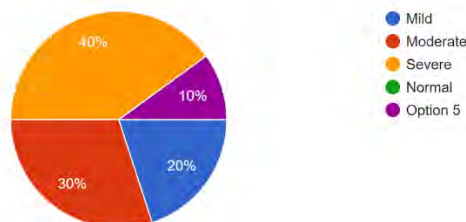


Figure 46: Concerned Govt. Agencies regular monitoring to control the price volatility & quality of construction materials

4.14.7 Strengthening Supply Chain of Construction Materials in Current Situations of World

Strengthening the supply chain of construction materials is crucial in the current global context, considering various challenges such as the COVID-19 pandemic, geopolitical uncertainties, and environmental concerns. A resilient and efficient supply chain is essential to ensure the timely availability of construction materials, minimize disruptions, and support the growth of the construction industry.

From our survey key supply chain changes needed now - early demand forecasting, optimizing logistics costs, vendor readiness mapping, and overall continuity planning to handle different disruption scenarios.

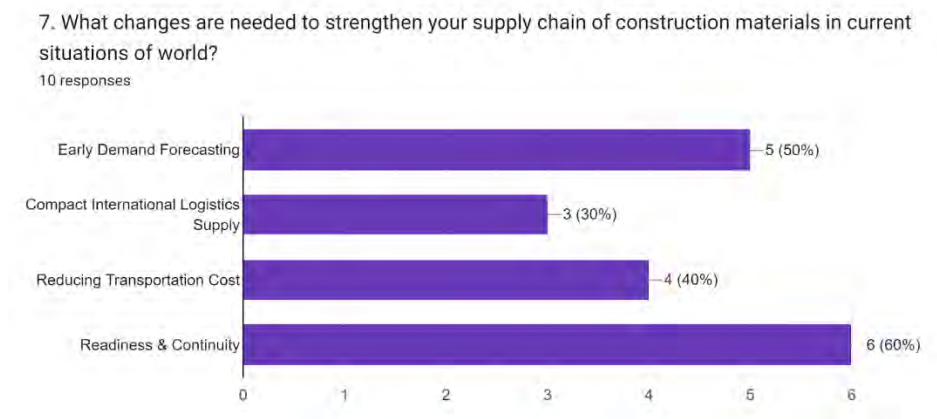


Figure 47: Strengthening supply chain of construction materials in current situations of world

Chapter 5

Conclusion & Recommendation

In conclusion, the study of the supply chain of construction materials during the post-pandemic period has revealed several critical insights that underscore the need for adaptability and resilience in the construction industry. The disruptions caused by the pandemic have exposed vulnerabilities in the existing supply chain, ranging from raw material procurement to distribution networks. As the industry continues to recover and evolve, it is imperative for stakeholders to embrace strategic measures that enhance the robustness and agility of the supply chain.

One key finding is the importance of diversifying sourcing strategies. The pandemic has highlighted the risks associated with over-reliance on specific regions or suppliers. Moving forward, construction companies should explore multiple sources for their raw materials to mitigate the impact of unforeseen disruptions. Additionally, establishing closer partnerships with reliable suppliers and implementing contingency plans will be essential to ensure a steady and secure supply chain.

Technology adoption has emerged as a significant factor in improving supply chain efficiency. The integration of advanced technologies, such as block chain for transparent and traceable transactions, artificial intelligence for demand forecasting, and smart logistics solutions, can enhance visibility and control across the supply chain. Companies that invest in these technologies will likely experience improved responsiveness and reduced lead times, ultimately contributing to increased overall resilience.

Furthermore, collaboration within the construction ecosystem is crucial. Strengthening communication and coordination among stakeholders, including manufacturers, distributors, and construction firms, can streamline the supply chain processes. Collaboration can lead to shared resources, better risk management, and faster response to market fluctuations, ensuring a more resilient supply chain.

5.1 Recommendations

Based on the findings of the study, the following recommendations are proposed for enhancing the supply chain of construction materials during the post-pandemic period:

Diversify Sourcing:

Explore and establish relationships with multiple suppliers for key construction materials to minimize the risk associated with supply chain disruptions.

Technology Integration:

Invest in advanced technologies, such as block chain, artificial intelligence, and smart logistics solutions, to improve visibility, traceability, and overall efficiency within the supply chain.

Collaboration and Partnerships:

Foster stronger collaboration among stakeholders in the construction ecosystem, including manufacturers, distributors, and construction firms, to enhance communication, coordination, and resource sharing.

Risk Management and Contingency Planning:

Develop robust risk management strategies and contingency plans to address potential disruptions, ensuring a more resilient and responsive supply chain.

Sustainability Initiatives:

Embrace sustainable sourcing practices and environmentally friendly materials to align with growing market demands for eco-conscious construction practices.

Reducing Carbon Foot Print in Construction Sector :

Construction activities contribute significantly to greenhouse gas emissions through energy consumption, material production, transportation, and on-site operations. For reducing the carbon footprint sustainable and low-carbon materials, such as recycled or reclaimed materials, and those with lower embodied carbon can be used. Locally sourced materials can reduce transportation-related emissions. Implement waste management plans to reduce construction waste and increase recycling. Aim for green building certifications (e.g., LEED, BREEAM) that emphasize sustainable construction practices and environmental performance.

Continuous Monitoring and Adaptation:

Implement systems for continuous monitoring of market dynamics and supply chain performance, allowing for timely adaptation to changing conditions and emerging risks.

By implementing these recommendations, stakeholders in the construction industry can work towards building a more resilient, efficient, and sustainable supply chain that is better equipped to navigate the challenges presented by the post-pandemic landscape.

References

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