

Impact of Precast Concrete Supply Chain During COVID-19 on Contractors

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Abstract: *Precast concrete is becoming more popular in Malaysia and is utilised extensively in the building sector because the components are essential parts of the contemporary building sector. The construction industry has had to deal with significant supply chain disruptions and problems ever since the World Health Organisation (WHO) reported the outbreak of the coronavirus illness 2019 (COVID-19), particularly in adapting to the new demands. All construction projects were postponed until further notice by the government. The COVID-19 pandemic has had a significant impact on various industries, including the precast concrete supply chain. However, the contractors need to know how to tackle the issues before it becomes worsen. This research aims to investigate the impact of the precast concrete supply chain during COVID-19 in Malaysian construction projects. Moreover, this research will focus on contractors who have a minimum of five (5) years of experience in the construction industry and will be conducted in Pulau Pinang area as this location have rapid growth of construction projects. Data for this research was collected through a questionnaire. There were 186 valid responses obtained from the questionnaire distribution to be analysed. Descriptive statistics were used to describe the survey data and analysed using Statistical Package for Social Science version 22 (SPSS) software. The results reveal that the building's material late delivery issue, project delay, an increase in overall construction cost, reduce quality of the project and reduce client satisfaction on project performance are the impact of the precast concrete supply chain during COVID-19 on the contractors. These findings can raise awareness among the contractors on the impact of the precast concrete supply chain during COVID-19 in Malaysian construction projects.*

Keywords: impact, precast concrete, supply chain, COVID-19

1. Introduction

Precast concrete components have grown in popularity in recent years as prefabricated building construction has accelerated not just in China but also in other regions of the world (Liu Z. et al., 2022). Precast structures are frequently used in building and bridge engineering due to their affordability, good quality, and ease of construction (Yahya et al., 2018). According to Mydin et al. (2014), using precast concrete systems is one of the options for reducing Malaysia's reliance on foreign labour in the construction sector.

Supply chain disruptions have a direct impact on performance and the capacity to meet client demands (Juttner U., 2011). The precast concrete supply chain involves various stages and stakeholders to ensure the production, transportation, and installation of precast concrete elements. Several disruptions have happened in the pandemic context, particularly in the global supply chain (Haren P, 2020). With the start of the COVID-19 epidemic, logistics and supply chains all across the world became tangled. With the pandemic's persistence, the situation deteriorated, having an impact on numerous delicate critical sectors including healthcare, transportation, spare parts, defence and security (De Vito & Gomez, 2020). Therefore, contractors must constantly adjust their willingness to deal with the impact of COVID-19 because it is now so variable (Smith, 2020). Therefore, this study is necessary to identify the impact of precast concrete supply chain during COVID-19 in the Malaysian construction projects.

2. Literature Review

Pandemic of COVID-19

Corona Virus disease is indicated by the abbreviation COVID-19. The condition is brought on by SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). The outbreak, which started in Wuhan, China, in December 2019, has been recognised as a serious global threat to human health. 502,772 persons had perished as of June 28, 2020, due to the virus (Worldometer, 2020). It frequently spreads through close contact within six feet by respiratory droplets created by coughing, sneezing, talking, and breathing, according to the Centres for Disease Control and Prevention (CDC). Due to a concentration of droplets persisting in the air for minutes to hours, it can occasionally spread by airborne transmission and infect others who are more than six feet away from the sick person (CDC, 2020a, b).

The World Health Organisation labelled the outbreak a pandemic on March 11, 2020, after the virus quickly spread to all seven continents. The COVID-19 outbreak, which has the potential to last for years and has an impact on many economic sectors, including construction, is the most severe issue of the current era (Harari, Y. N., 2020). Various movement restriction measures have been introduced to slow the spread of the disease (Nair, 2020). The Malaysian government agreed to enact a Movement Control Order (MCO) that will be in place from 18 March 2020 to 31 March 2020 to reduce the spread of infection. After the MCO had been in force for two weeks, new cases were rising with occasional plateauing, therefore the MCO was extended from April 1 through April 28, 2020.

Due to its multidimensional structure and the complex, tactical, strategic, internal, and transactional relationships it has within the supply chain, the construction industry has been adversely impacted by the epidemic. The value of construction work completed in Malaysia decreased by 44.9% in the second quarter of 2020 (Department of Statistics Malaysia, 2020).

Precast Concrete Supply Chain before COVID-19

Precast concrete construction is gaining popularity in the building sector because of its advantages over in situ concrete production, including shorter construction times, superior quality, and reduced environmental effects (Wang et al., 2019; Kim et al., 2020). Since precast concrete construction generates less carbon footprints during manufacture and installation than does traditional construction, it is viewed as the greener option for the sector (Jiang and Wu, 2021). According to Shen and Qi (2018), a favourable manufacturing environment and dependable transportation distance enable a 20% cost reduction of precast concrete component

on production line operations. Therefore, lack of supply chain management would cause material shortages, which would prevent many commodities from being provided as usual and from meeting demand in a timely manner (Sarkis et al., 2020).

3. Impact of Precast Concrete Supply Chain during COVID-19 on Contractors

Late Delivery of Material

Due to COVID-19's disruption of the material and supply chains, the construction industry in Malaysia has to deal with a major problem (Gara et al., 2022). Late delivery of materials can be frustrating for contractors and clients. Precast concrete components that are delivered late from the factory to the site can cause work delays at the site, a longer construction period, and higher labour costs. Zhaojing W. and Hao H. (2017), who agree that the main barrier limiting the productivity of the entire project is the early or late delivery of precast concrete to the construction site, corroborate this.

Project Delay

The severe acute respiratory syndrome-2 disease (COVID-19) had an influence on the government's revenue, and many public projects were predicted to be postponed or cancelled as a result, providing little opportunity for the creation of new public projects (Financial Nigeria, 2020). A client decision or an imposed government order may cause a project to be suspended (Ogunnusi et al., 2020).

Governments had put in place public health measures including work-hour restrictions to limit the spread of the virus. The project's development was unable to keep up with the timeline as a result, which caused delays in project delivery (Adam et al., 2020). Delays in ongoing projects and a slowdown in new project starts may impact contractors' future prospects. Another factor that contributed to delays was the difficulty in acquiring licences and planning approvals during the epidemic, according to Stride et al. (2020). This is due to the fact that some authorities were unprepared to handle remote work and were unable to process the permit application.

Construction Cost Increment

The disruptions in the supply chain and increased demand for certain construction materials have led to price increases. According to Amri and Marey-Perez (2020), the pandemic had increased the cost of construction materials since it had disrupted the worldwide supply chain for those products. Naturally, the cost of materials increased as supply decreased. Al Mansoori et al. (2021) claim that the UAE's economic sector has been severely hampered by the rising cost of construction projects and labour.

Social distancing requirements also increased the need for larger work areas and additional space, leading to increased construction costs. Contractors had to follow additional site operating protocols during the pandemic, including taking temperatures, providing masks to workers, and completing daily self-check forms (Adam et al., 2020; Stride et al., 2020). In addition, new amenities like hand sanitising stations had to be installed (Jallow et al., 2020). Regular mass testing of site employees and visitors is required to reduce new COVID-19 clusters. The enormous number of people required for a construction project resulted in significant expenses for construction businesses (Choong, 2021).

Reduce Project Quality

Many businesses have experienced disruptions in their supply chains due to lockdowns, travel restrictions, and reduced production capacities. This can lead to delays in receiving necessary materials or equipment, affecting the overall quality and timeliness of projects. Labour shortages and restrictions on movement have affected the availability of skilled workers, subcontractors, or specialized personnel required for certain projects. According to Chowdhury et al. (2021), new measures including reducing office hours and maintaining social distance had contributed to a workforce shortage, sharply lowering productivity. In addition, Alavinia et al. (2011) claim that having health issues at work will cause a major decrease in labour productivity. The lack of specific expertise or experienced personnel can potentially impact the quality of project deliverables.

Other than that, every economy currently practices such social distance and has strongly embraced working remotely or from home rather than doing so in workplaces (Baveja et al., 2020). Online communication became essential for individuals, businesses, and organizations to stay connected and continue their operations. However, online communication and visualisation aids during COVID-19 are not as effective as seeing the actual situation on-site. The development of the work had been hampered by the difficulty in identifying the problems (Jallow et al., 2020).

Reduce Client's Satisfaction with Project Performance

Ensuring client satisfaction during the COVID-19 pandemic can be challenging, as it has significantly impacted businesses and altered customer expectations. There can be several issues that impact client satisfaction with a contractor's performance. Employees had difficulty focusing because of the change in routine, which included no longer having to commute to and from work and additional distractions (Stride et al., 2020).

Additional site protocols, such as temperature monitoring, social isolation, and filling out daily health check-in forms, also had a negative impact on labourers' output (Amri and Marey-Perez, 2020). As a result, the time dedicated to productive work unavoidably decreased as a result of these extra steps. The new standard operating procedures have made site visits during the epidemic less practical (Ghandour, 2020). As a result, work has been redefined. The pandemic's impact on project execution, resource availability, and team dynamics may result in compromised project quality. Clients may be dissatisfied if the final deliverables do not meet the expected standards or if the project falls short in terms of functionality, reliability, or performance.

4. Methodology

The method used for collecting the data information is by using a questionnaire survey. The questionnaire has been checked and approved by Faculty/Branch Ethics Review Committee Universiti Teknologi MARA (UiTM) before it was distributed to the respondents who registered with the Construction Industry Development (CIDB) under the Grade 7 category. Other than that, the contractors also must have a minimum of five (5) years of experience in the construction industry in order to identify the impact of supply chain disruption especially for precast concrete during the COVID-19 pandemic. This research was conducted in Pulau Pinang area as this location has rapid growth of construction projects in building and infrastructure works.

The primary data collection was conducted in this research which is a questionnaire survey that was distributed to the available contractors in the Pulau Pinang. For the secondary data collection, the information was gained from literature reviews such as reference books, published journals, articles, and research papers and the internet. This method is used to support the primary data collected.

Descriptive statistics, which are under the category of quantitative data analysis, were the analysis approach employed for this study. Additionally, the mean, median, and mode are important tendencies that are measured by this type of methodology. Therefore, using these techniques and analysis, the results will be used to draw conclusions and provide recommendations. A total of 361 contractors from the selected areas in Pulau Pinang were qualified to be a respondent for this research. The sample size of 187 respondents was determined by using Krejcie & Morgan formula. However, only 186 respondents filled out the survey form.

5. Result

Demographic Background

The general information of the respondents in this study includes their gender, age, position, working experiences, number of projects handled, number of suppliers and project status due to the COVID-19 pandemic crisis.

Table 1: Participant’s Demography for the Study

Category	Item	Frequency	Percentage (%)
Gender	Male	100	53.80
	Female	86	46.20
Age	20 – 29 years old	38	20.40
	30 – 39 years old	101	54.30
	40 – 49 years old	46	24.70
	50 years old and above	1	0.50
Position	Project Manager	39	21.00
	Manager	25	13.40
	Quantity Surveyor	85	45.70
	Site Supervisor	37	19.90
Years of involvement	5 – 10 years	60	32.30
	11 – 15 years	72	38.70
	16 -20 years	39	21.00
	21 years and above	15	8.10
No.of suppliers	Below 10 suppliers	40	21.50
	10 – 20 suppliers	86	46.20
	21 – 30 suppliers	50	26.90
	31 suppliers and above	10	5.40

Table 1 presents the summary of the participants’ demographic backgrounds. It is indicated that more men are involved in construction work than women. Most of the respondents are age between 30-39 years old which represent 54.30% of the total respondents. Many of the participants, who represent 45.70% of the total participants, were Quantity Surveyors at contractor companies. Regarding the working experience, most of the respondents are having

11-15 years of working experience in the construction industry; therefore, their responses and opinions are relevant based on their working experiences. 46.20% of the total respondents are having 10-20 numbers of suppliers for their construction project.

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Table 2 shows the findings and demonstrates the assessment of the impacts based on the level of effect using Likert’s type scale. A total of 186 respondents participated in answering the questionnaire survey. It is illustrated that the precast concrete supply chain during the pandemic COVID-19 give an impact on the late delivery of building materials with an average mean of 4.41. The second most affected part is the project delay with an average mean of 4.41. The increase in the overall construction cost of the project was at the third rank with a mean of 4.37. The reduced quality of the project will also be affected during COVID-19 at the fourth rank and reduced client satisfaction was at the last rank. The findings highlight the importance of preparing the construction industry, particularly contractors, to deal with a sudden pandemic, especially in the supply chain.

Table 2: The Impact of the Precast Concrete Supply Chain During COVID-19 on Contractors

The impact of precast concrete supply chain during COVID-19 on contractors	Frequencies for Likert Scale					Mean	Rank
	1	2	3	4	5		
Building’s material late delivery issue	-	-	3	104	79	4.41	1
Project delay	-	1	11	84	90	4.41	2
Increase overall construction cost	-	1	10	95	80	4.37	3
Reduce the quality of the project	-	4	16	96	70	4.25	4
Reduce client satisfaction with project performance	-	6	32	73	75	4.17	5

6. Discussion

The descriptive analysis was used to know the details of respondents and found that the majority of respondents are affected by the precast concrete supply chain during COVID-19. These findings provide empirical support to the existing literature on the impact of the precast concrete supply chain during COVID-19 on contractors. The impact of the precast concrete supply chain during Covid-19 on contractors in Malaysia such as late delivery of building materials, project delay, increase overall construction cost, reduce quality of the project and reduce clients’ satisfaction with project performance. This is supported by Gara et al. (2022) who agree that late delivery of precast concrete components from the supplier resulted in the delay of project work progress. In addition, the pandemic has caused the industry to experience project delays and suspensions, a shortage of materials, low productivity, material cost inflation, revenue shrinkage, supply chain disruption, and cost and time overruns (Alsharef et al., 2021; Gamil and Alhagar, 2020; Shafi et al., 2020).

7. Conclusion

This article has investigated and assessed the impact of the precast concrete supply chain during the pandemic COVID-19 on the contractors. The majority of Pulau Pinang's construction projects have been adversely impacted by the COVID-19 epidemic. It is statically proven that the building material’s late delivery, project delay, overall construction cost increment, reduce the quality of the project and reduce client satisfaction on project performance are the main impact of the precast concrete supply chain during COVID-19 on the contractor. The findings

of this article are intended to help contractors, stakeholders and policymakers in the construction industry understand the impact of the precast concrete supply chain during an unanticipated and uncontrolled pandemic faced by contractors in Malaysia's construction industry. The industry needs to adapt and implement new strategies to overcome these challenges and ensure the safety of workers and the continuation of construction activities. Adaptability, collaboration, and proactive measures were crucial for minimizing the negative effects and maintaining operations during this challenging period.

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