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## Effect of COVID-19 on building construction projects: Impact and response mechanisms

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# Effect of COVID-19 on building construction projects: Impact and response mechanisms

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**Abstract.** The construction industry plays significant roles in the country's economic development and growth. There would be a domino impact on the economy if any construction projects are being delayed. As the pandemic of COVID-19 had arisen into our global that had affected the construction industry, including building projects. Identifying the underlying problems caused by COVID-19 can provide the best solution to reduce the pandemic's impact. Consequently, emphasizing the impact of COVID-19 and the strategies to address those problems in the building construction industry becomes vital. Thus, this research objective is to identify problems caused by COVID-19 in the building construction industry and mechanisms to reduce COVID-19's negative impact. The data collection involved individual interviews with 20 contractor companies that are engaged in building construction projects. Then, the data is analyzed using the thematic analysis approach. The findings show that COVID-19 is causing operational and financial issues, while financial aids and complete information is needed to overcome those impacts. These findings will help policymakers improve existing strategic plans and create new policies to cope with the circumstances caused by COVID-19 among building construction organizations.

**Keywords.** Sustainable Development, COVID-19, Construction industry, Decision making.

## 1. Introduction

The construction industry plays a significant role in the nation's economic, societal, and political development [1]. The pandemic of COVID-19 had arisen into our global that had affected the construction industry. Due to this pandemic, all construction activities have stopped following the Movement Control Order (MCO) by the Malaysian government. Work from home may not be practical, as the physical activity must be conducted on-site. There would be a high impact on Malaysia's economic growth if any major construction projects got delays [2]. Therefore, finding approaches to reduce the adverse effects of COVID-19 is crucial to avoid negative economic growth in the nation that can eventually result in an economic recession.

One of the approaches to reduce the impact of COVID-19 in the construction industry is to identify the emerging problems that the industry players are facing in this complicated situation. The information obtained was then analyzed to develop solutions to reduce the crisis's impact. Finally, critical solutions will be evaluated to get the most efficient solution for those issues.



However, the construction organization consists of different class types and different project types. Larger contractors may have different perspectives than small and medium enterprises (SME) contractors on the problems faced because of COVID-19, and different mechanisms are needed to overcome the problems. Likewise, the issues on building projects might be different from infrastructure projects. Thus, comprehensive identification of problems caused by COVID-19 in the construction industry is required to determine optimal mechanisms for them. This study is conducted to identify the best mechanisms for reducing COVID-19's negative impact on the building construction industry. Thus, the objectives are: 1. Identify problems caused by COVID-19 in the construction industry, 2. Determine mechanisms that can reduce COVID-19's negative impact.

## 2. Literature Review

The review of the existing literature is divided into three subsections. First is COVID-19's impact on the construction industry, next is strategies to address COVID-19 in the construction industry, and lastly, the study's positioning in various literature as to intensify the research gap.

### 2.1. COVID-19's impact on the construction industry

COVID-19 has caused delays in construction projects. Alenezi [3] collected quantitative and qualitative data from a wide range of professionals in the construction industry. The questionnaire was sent to 205 construction sector practitioners working in Kuwait, including engineers, architects, surveyors, construction management, and coordinators. Several categories of delay in construction projects during COVID-19 were identified: critical delay, concurrent delay, independent delay, non-excusable delay, and excusable delay. Most common reasons for delays in projects because the daily working period has been shortened.

The COVID-19 pandemic has a tremendous negative impact on corporate performance. Shen et al. [4] identified the effects of listed Chinese companies' financial data from 2013 to 2019 to predict corporate performance. The comparison is then made of the financial data from 2014 to 2020 to get the descriptive statistic on how it has affected the performance.

Gamil and Alhagar [5] conducted an exploratory interview with ten selected experts from the construction industry sectors in Malaysia to share and express their insights and opinions on the construction industry's current state in the mid of the pandemic. Quantitative data also had collected on 129 respondents. The data analysis results have shown the suspension of projects, workforce shortage, and time and cost overruns are the most impacting factor by the COVID-19.

### 2.2. Strategies to address COVID-19 in the construction industry

In identifying strategies to address COVID-19 in the construction industry. Luo et al. [6] had identified the three challenges facing in the design and construction of Leishenshan Hospital during COVID-19, which are project delivery, design optimization, and communicating information among project stakeholders. The semi-structured interviews of key stakeholders from Leishenshan Hospital was conducted to address solutions the resolve the problems. Based on data collected from various sources, they found that adhering to a product, organization, and process (POP) modeling approach combined with building information modeling (BIM) allowed for the ultra-rapid creation, management, and communication of project-related information, resulting in the successful development of this fully functional, state-of-the-art infectious disease specialty hospital.

Kabiru and Yahaya [7] addressed the impact of COVID-19 and discovered that professionals are faced with some challenges in the construction industry. The adverse effects of COVID-19 had a significant impact, including affecting on-site work activities, the bill of quantities, project completion, law of contract, causing Force Majeure events in the Nigerian construction industry. Through the analysis, both parties (contractors and employers) agree that present COVID-19 poses a significant challenge in the construction industry. Therefore, the parties should tender a claim relieving them from Force majeure event in good time.

The 2015–2030 Sendai Framework for Disaster Risk Reduction (SFDRR) aims to enhance national and community capacity to cope with disaster risks. It emphasizes a comprehensive approach to

addressing multiple hazards (technological, biological, and environmental) that impact different scales, frequency, and intensity [8]. Djalantea et al. [9] argue that current mechanisms and strategies for disaster resilience, as outlined in the SFDRR, can enhance responses to epidemics or global pandemics such as COVID-19. In this regard, they have come out with several general and DRR-specific recommendations. These recommendations concern knowledge and science provision in understanding disaster and health-related emergency risks, the extension of disaster risk governance to manage both disaster risks and potential health-emergencies, particularly humanitarian coordination aspects; and strengthening community-level preparedness and response.

### *2.3. Study's Positioning*

Several researchers have studied the effects of COVID-19 on the construction industry. However, Alenezi [3] focused on the construction project in Kuwait. Therefore, the impact on the construction industry in Malaysia has not been explicitly identified. Also, the respondents were selected randomly, where no specific area is targeted in Kuwait. The respondents were involved in various projects in the building, water supply, sanitation and water, and energy sectors. On the other hand, Gamil and Alhagar [5] attempt to identify the construction industry's impact in general. Also, Shen et al. [4] focus on various sectors affected by COVID-19. In other words, these studies are not explicitly focusing on the detailed impact of COVID-19 on the building construction industry.

Next, the importance of this study is to explore the mechanism needed by industry practitioners. Luo et al. [6] studied the challenges and solutions in construction works during COVID-19. The finding on the challenges is related to how to improve the construction progress and decision-making. Kabiru and Yahaya [7] addressed the solution to the problems related to contracts. Djalantea et al. [9] studied the 2015–2030 Sendai Framework for Disaster Risk Reduction (SFDRR) to disaster risks and potential health-emergencies to emphasize different risk reduction strategies during COVID-19. They had addressed the significant strategies for issue related COVID-19, specifically on health-related emergency risks for humanitarian coordination aspects. Therefore, this study intends to identify the impact and strategies to address those impacts by COVID-19 in the building construction industry in the Malaysian context to generate the most effective response plan for the local construction industry.

## **3. Methodology**

The data collection involved the interview with the contractor's companies who had been involved in building construction projects. A qualitative approach has been used to analyze the collected data. The following subsection discusses how the data collection has been collected and been analyzed.

### *3.1. Data Collection*

The data collection has been collected by having an open-ended interview with the owner or project manager of 20 contractor's companies in Malaysia. This approach has been used to identify success factors in other construction management topics, including design-build public sector projects [10] and highway projects [11]. Three questions have been asked: 1) What problems the construction industry is facing post-COVID-19? 2) What mechanisms are effective in solving those problems? And 3) What government assistances are effective in solving those problems?. Question 1 aims to obtain information on how their company had affected by Covid-19. Questions 2 and 3 aim to obtain their perceptions on the potential mechanism and government assistance that effectively address the problem faced by their company due to COVID-19. The open-ended interview is used to encourage as much detailed information as desired. Table 1 shows the interviewee's list from the 20 contractor's companies in Malaysia that are randomly selected from G1 until G7 contractors. Most of the respondents for G1-G3 company are the owner while for G4-G7 company are the project manager. The company owner is the person who has full knowledge of the company from project, financial, and staff. The project manager is the person who manages the construction project at the site and delivers the information of all construction activities to associates. The targeted respondents may be able to give the information as needed. The 20 respondents from different contractor's classes are required as different perspectives will acquire from them. After each interview, a summary of the interview was made and sent to the respondents for validation purposes.

**Table 1.** List of Interviewees.

No	Stakeholder ID	Position	Contractor Grade
1	Contractor 1	Owner	G2
2	Contractor 2	Owner	G1
3	Contractor 3	Project Manager	G5
4	Contractor 4	Owner	G3
5	Contractor 5	Project Manager	G6
6	Contractor 6	Owner/Director	G7
7	Contractor 7	Owner	G2
8	Contractor 8	Project Manager	G7
9	Contractor 9	Project Manager	G5
10	Contractor 10	Project Manager	G1
11	Contractor 11	Owner	G2
12	Contractor 12	Owner	G3
13	Contractor 13	Project Manager	G1
14	Contractor 14	Owner	G5
15	Contractor 15	Project Manager	G1
16	Contractor 16	Finance	G1
17	Contractor 17	HR	G1
18	Contractor 18	Owner	G1
19	Contractor 19	Project Manager	G7
20	Contractor 20	Project Manager	G6

### 3.2. Data Analysis

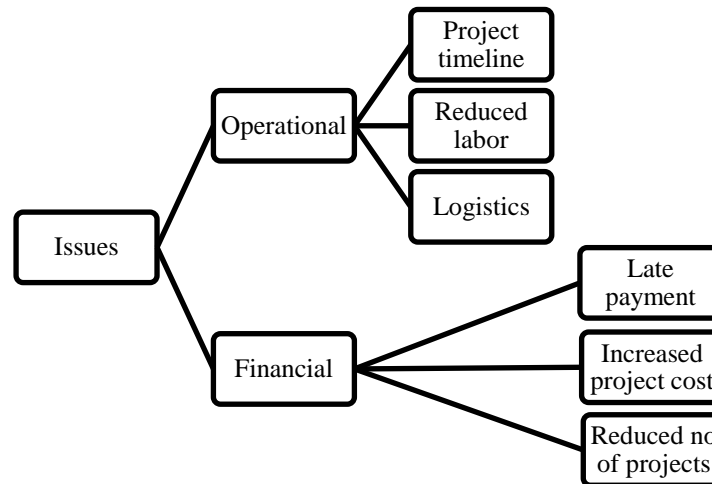
Thematic analysis is performed for qualitative data analysis to identify the negative impact of COVID-19 and identify the best mechanisms for reducing COVID-19's negative impact on the construction industry. The approach was used to assist in making sense of qualitative data. Other construction management studies that employed this method to analyze qualitative data include identifying problems in construction projects [12], attributes of change agents in construction companies [13], and parameters for highway construction projects [14]. The thematic analysis is conducted based on the six phases adopted from Braun and Clarke [15]. The first phase is to familiarize with the data. The authors transcribed the interview data, read, reread, and noted the initial ideas. The second phase is to generate the initial codes. The authors coded for as many potential themes and patterns as possible from the data. The authors then reviewed, discussed, and agreed on any additions and/or changes to the coding. The third phase is to search for themes based on the initial codes. During creating the themes, the authors frequently revisited the codes from the second phase and the original data from the first phase. The fourth phase is to review the themes. To ensure the data saturation, the authors continually reviewed the subthemes, defined and refined them, checked if themes work to the coded extracts and the entire data set, and reviewed data to search for additional themes. The fifth phase is to define and name the themes. The authors continually went back and forth between the themes, codes, and transcription of the interview to ensure that the themes were true to the independently coded responses. The final phase (sixth phase) is to report the output of the analysis.

## 4. Results and discussion

This study shows the result of the interviews conducted with 20 contractor companies in Malaysia. The contractors were interviewed to identify the construction industry's problems caused by COVID-19 and the potential mechanisms that may effectively solve them.

#### 4.1. Problems caused by COVID-19

Figure 1 and Table 2 summarize the themes and subthemes of problems the construction industry faces by COVID-19. From 20 companies, six categories which are: “Project timeline,” “Reduced labor,” “Logistics,” “Late payment,” “Increased project cost,” and “Reduced no of projects” are identified to be the subthemes. The six categories can be grouped into two themes: “Operational” and “Financial.” The details of themes and subthemes are discussed in the subsequent subsections.



**Figure 1.** Overview of the problems the construction industry is facing by COVID-19.

**Table 2.** Problems the construction industry is facing by COVID-19.

	Contractor 1	Contractor 2	Contractor 3	Contractor 4	Contractor 5	Contractor 6	Contractor 7	Contractor 8	Contractor 9	Contractor 10	Contractor 11	Contractor 12	Contractor 13	Contractor 14	Contractor 15	Contractor 16	Contractor 17	Contractor 18	Contractor 19	Contractor 20	Total no of hits	
<b>Operational</b>																						
Project timeline	√		√	√			√	√	√	√	√		√	√	√	√		√	√	√	√	15
Reduced labor	√			√			√	√				√			√	√	√		√			9
Logistics	√			√	√			√	√		√	√	√						√			9
<b>Financial</b>																						
Late payment					√	√										√						3
Increased project cost				√		√		√				√		√	√	√	√		√			8
Reduced no of projects		√	√	√	√	√	√					√	√					√	√	√	√	12

##### 4.1.1. Operational problems

The operation of companies and construction works is the central aspect of the construction business industry. Three factors are identified related to the operation, which are Project Timeline, Labor, and Material. Due to COVID-19, these three factors facing problems that caused the project operation to delay.

*Project timeline.* Project Timeline is a schedule of project work from starting until the expected time completion of construction work. Due to COVID-19, the government had imposed the Movement Control Order (MCO) started 18 March 2020 and had extended until 31 December 2020. However, the

construction industry can resume operation began on 4 May 2020. The change of project timeline happened because construction activity had stopped during MCO that caused project delay. They also need to follow SOP at construction sites that slow the progress of the project. The second factor that creates changes in the project timeline is the authority's late approval. The authority's office was also closed during MCO. During Conditional MCO, the office had resume operation, but the operation hour had reduced. The responses based on the summary of the interviews are as following:

*“During the MCO, construction work was affected. After getting approval from MITI, construction work resumed, but it encountered some difficulties because it had to comply with the government's SOP. Construction work that is interrupted is not a problem because the government plans to extend the project's construction period.” (Contractor 13)*

*“There are several projects that have been submitted to the municipality before MCO to get approval. Due to MCO, all projects submitted to the council were delayed due to the council's operating hours were shortened. Only in July, operating hours were running as usual.” (Contractor 3)*

*Reduced labor.* Companies are facing a shortage of skilled workers, mostly foreign workers. Many foreign workers were going back to their country due to COVID-19. However, existing and new foreign workers could not come to Malaysia because the government has restricted foreign workers' entry into Malaysia. Lack of workers caused delays in construction works. Examples of the respondents from the summary of the interview are as follow:

*“During the MCO, foreign workers are sent to their home country after their work permits have expired. Only one worker left now. Companies have a shortage of employees to complete their projects, but the remaining work is in the final phase. Although an employee alone but can complete the work.” (Contractor 4)*

*“Foreign workers are not enough to do construction work. Foreign workers mostly returned to their country of origin when Covid-19 struck. The company could not hire new foreign workers because they could not return to Malaysia due to government restrictions.” (Contractor 12)*

*Logistics.* This parameter explains material delay issues due to cross-country procedures and shortens of supplies due to the supplier company's operations being suspended and high demand for supplies after MCO. Examples of the respondents from the summary of the interview are as follow:

*“Most of the project materials are imported from overseas and some from other states. During MCO, no delivery work, cross-country, and state is allowed. When the delivery works are permissible, the delivery of project materials becomes slow because they had to follow new procedures (SOPs) that have been set.” (Contractor 1)*

#### 4.1.2. Financial problems

Financial problem is the second issue caused by COVID-19. Three factors that cause financial problems during COVID-19 are late payment, project cost increase, and reduced projects.

*Late payment.* Project payments are usually paid in phases. For government projects, payment will be made after the company claims the completed project's work phase. The payment of claims made was delayed due to disrupted government operations during the MCO. The responses based on the summary of the interviews are as following:

*“The company has to wait for payments of 1 to 2 months late by the government, causing the company to have some capital turnover problems.” (Contractor 16)*

*“The company is experiencing a decline in profits due to lack of projects. The company is also experiencing the problem of demanding late payments from the government for*

*government projects. These things cause companies to lack capital to pay employees.” (Contractor 5)*

*Increase project costs.* A few factors identified had increased the project cost, including the higher price of materials and the COVID-19 test procedures cost. The higher material price is caused by the changes in foreign exchange rates and the increased demand for supplies. Also, COVID-19 test procedures have given the additional cost to the company.

*“Project materials experienced a slight price increase. Raw materials are also difficult to obtain during MCO because many shops are closed & still not operational.” (Contractor 18)*

*“When site work had to be stopped during MCO, the company had to bear the cost of foreign workers such as food, shelter, and COVID-19 screening test because the foreigners are not eligible to receive financial aids in general.” (Contractor 19)*

*Reduced number of projects.* During MCO, the company facing problems to get new projects. It is because of the limited award of new tenders and competitiveness of contractors. There is a little award of new tenders by the government because some projects are still restricted during MCO. The competitiveness of contractors is higher when the total number of projects has decreased. Therefore, SME contractors face more difficulties in getting new projects, as they need to compete with larger contractors. Also, this scenario makes it more difficult for them to get projects during COVID-19. Examples of the respondents from the summary of the interview are as follow:

*“For now, only one project is still running. For the new project, the company is still waiting for a government quote to enter the tender. For G1 class contractors, they can only apply for projects around Johor Bahru.” (Contractor 18)*

*“Lately, projects have been hard to get, especially they are lower-grade contractors. They have entered the project tender, but it is difficult to get the tender because of higher-grade contractors. Higher-grade contractors have more licenses than the medium and small ones, and they can enter many tenders at once.” (Contractor 2)*

#### *4.2. Mechanisms to address problems caused by COVID-19*

Figure 2 and Table 3 summarize the themes and subthemes of the mechanism needed in solving the construction industry's problems by COVID-19. From 20 companies, six categories, which are: “SOP,” “Details,” “Townhall,” “Grants,” “Fundings,” and “Loans” are identified to be the subthemes. The six categories can be grouped into two themes: “Complete information” and “Financial aids.” The details of themes and subthemes are discussed in the subsequent subsections.

##### *4.2.1. Complete information*

Informative and sufficient information (i.e., complete information) is one solution to tackle the problem by COVID-19. Three aspects are identified related to information, which is SOP, Details, and Townhall. These three aspects can assist the company in tackling the problem.

*Standard Operating Procedure (SOP).* The government issues Standard Operating Procedure for the Ministry of Works' construction sector when the construction industry is permitted to operate started 4 May 2020. There are many procedures to follow. As a contractor, to deal with COVID-19, following the SOP is one way that can prevent the virus from spreading and infecting. The respondent's response is as follows:

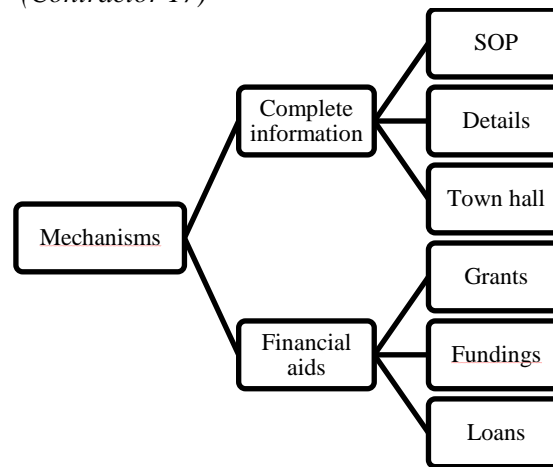
*“The influence of lower grade contractors on the national economy is small compared to higher grade contractors. So, the way they can deal with the issues they face is just by following the SOP.” (Contractor 1)*



*Details.* Details on government assistance needed about the scheme and grant provided by the government for the company may apply. Example of the respondent from the summary of the interview as follows:

*“The company tried to apply for the PRIHATIN Special Grant from PENJANA in August but had missed out because the application period had expired. Companies miss out on applying because details related to this grant are known to be late, and various documents need to be provided to apply.” (Contractor 17)*

*“The government is advised to improve in conveying relevant details during this Covid-19, especially grants or funds to the company. The government must have each company's data, such as email or mobile phone number for them to send messages or related info to contractor companies.” (Contractor 17)*



**Figure 2.** Overview of the mechanisms to address COVID-19’s impact.

**Table 3.** Mechanisms to address COVID-19’s impact.

	Contractor 1	Contractor 2	Contractor 3	Contractor 4	Contractor 5	Contractor 6	Contractor 7	Contractor 8	Contractor 9	Contractor 10	Contractor 11	Contractor 12	Contractor 13	Contractor 14	Contractor 15	Contractor 16	Contractor 17	Contractor 18	Contractor 19	Contractor 20	Total no of hits	
<b>Complete information</b>																						
SOP	√																√	√			3	
Details						√															1	
Town hall												√									1	
<b>Financial aids</b>																						
Grants	√																				1	
Fundings	√				√																2	
Loans	√											√									2	

The company is also facing a lack of skilled workers to do the construction work. Since the foreign workers have been restricted from entering Malaysia, local skill workers are needed. However, the problem of getting the local skill worker also becomes an issue. Details about them are necessary for job offers. The respondent from the summary of the interview is as follows:

*“The biggest issue for companies is the lack of skilled workers. A mechanism is needed to address this issue to liaise with bodies such as CIDB, which provides many construction*

*courses to list qualified graduates. Hence, the company can contact and offer jobs to them.”*  
(Contractor 18)

*Townhall.* Townhall meetings by government bodies with contractors are also needed to receive all the information regarding SOP, MCO issues, grants, and fundings. Some contractors live in rural areas where the information through the internet may not be adequate. Townhall meetings can provide a practical question and answer sessions between contractors and the government. Monthly Townhall meetings have been suggested by one of the respondents:

*“The company did not receive any government assistance. A suggestion that can improve this situation is by having the government hold a meeting about half a month once for a detailed explanation of available schemes related to COVID-19. The meeting is to make the information presented more proactive, and no one is left out or misinformed.”* (Contractor 12)

#### 4.2.2. Financial aids

One of the problems that the construction companies are facing is financial. These contractors need financial aids that can be divided into three categories: Grants, Fundings, and Loans. The financial aid may benefit them in running the operation, paying staff salaries, and supporting the project cost.

*Grants.* The government has provided PRIHATIN Economy Stimulus Package, where PRIHATIN Special Grant MYR3000 will be provided to the company's annual income is not more than MYR300,000. Most of the contractor companies are not eligible to apply for this grant. They are hoping the government will reduce the application term to apply for the grant:

*“The majority of contractors are not eligible / didn't get because the terms of the application imposed are not met. The government is advised to reduce the eligibility terms of application and increase the grant so that more contractors can get jobs.”* (Contractor 1)

*Fundings.* The government has provided PENJANA Micro Finance with MYR 400 million to support entrepreneurs and companies. Some of the respondents informed they had applied the finance but been rejected as the bank told the scheme has a lack of funds.

*“In addition to the existing financial aids (the Wage Subsidy Program and Employment Retention Program, the government can consider providing interest-free funds or capital loans to help companies continue existing projects or pay employees' salaries.”* (Contractor 5)

*Loans.* A loan is vital to the company as it may running the project cost. However, if their company capital is low, it may be harder to get a bank loan.

*“Employers can also involve banks or GLC bodies to provide more loan schemes, etc. to companies, especially the construction industry.”* (Contractor 12)

## 5. Conclusion

This study has identified the problems caused by pandemic COVID-19 on the building construction industry, and the mechanisms to reduce COVID-19's negative impact. The study findings suggest that COVID-19 is impacting the building construction industry by causing operational and financial issues. The operation is effected as project timelines due to shortening the time of construction activities and late approvals by related authorities. Besides, the shortage of skilled workers and supplies, and logistic issues have affected project operation. In addition to the current countermeasures, the government could provide other mechanisms to reduce the impact of COVID-19 in the building construction industry. Most companies require financial aid to encounter them with financial issues. Therefore, these companies need to have complete information about existing and future financial aids from the government and banks. Also, complete information on local skill workers is necessary for dealing with the lack of foreign workers. These findings are essential to the construction industry stakeholders and policymakers to understand the unforeseen and uncontrolled pandemic in the building construction

industry. This will help improve strategic plans and create a new policy to cope with any encountered circumstances. Lastly, the qualitative data on the problems and mechanisms can develop a questionnaire survey to model a large population's characteristics to have a more comprehensive data about the criticality of the problems and mechanisms.

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