

## **Study of Construction Project Delay Due to COVID-19 Pandemic in Construction Industry**

**Lam Jing Yin<sup>1</sup>, Rozlin Zainal<sup>1,2\*</sup>, Narimah Kasim<sup>1,2</sup>, Sharifah Meryam Shareh Musa<sup>1,2</sup>**

<sup>1</sup>Department of Construction Management, Faculty of Technology Management and Business,  
Universiti Tun Hussein Onn Malaysia (UTHM) Parit Raja, Batu Pahat Johor, 86400, MALAYSIA

<sup>2</sup>Centre of Excellence for Facilities Management (CeFM), Faculty of Technology Management and Business,  
University Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor, MALAYSIA

\*Corresponding Author Designation

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**Abstract:** The pandemic of COVID-19 had arisen into our global that had affected the construction industry. Due to the COVID-19 pandemic, most construction project delays have occurred. The purpose of this research is to identify the impacts of the COVID-19 pandemic on construction project delay and the strategies to cope with the COVID-19 pandemic. The majority of contractors in Sibuloh Town, Sarawak registered in Grade 1. This research uses a quantitative method to achieve all of the objectives. This study surveys the 175 perceptions of Grade 1 contractors in Sibuloh Town, Sarawak. The respondents were given a questionnaire in a link of google form through WhatsApp. A total of 108 respondents have given feedback in the questionnaire which is 61.71%. Descriptive statistic by SPSS software was used to analyse the data for all objectives. This research find that the main impact and strategy respectively delay in material delivery and two-meter social distancing rule recorded as the highest frequency. This research can be a reference to the Grade 1 contractors and the person who participated in the construction industry is aware of the most significant impact of the COVID-19 pandemic and use the most appropriate strategy to address the COVID-19 pandemic.

**Keywords:** COVID-19 Pandemic, Grade 1 Contractors, Impact, Strategies

### **1. Introduction**

The pandemic of COVID-19 had arisen into our global that had affected the construction industry. According to Donaldson (2018), the construction industry plays an important role in the country's economic, social and political expansion. The Malaysian government has stopped all construction

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\*Corresponding author: [rozlin@uthm.edu.my](mailto:rozlin@uthm.edu.my)

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activities in accordance with the first and second phases Movement Control Order (MCO) which from is 18th March 2020 until 14th April 2020 due to the COVID-19 pandemic (Foo & Kaylee, 2020). The construction industry is very distinct from other industries, which usually require the on-site participation of all project members. If any major construction project is delayed, it will have a significant impact on Malaysia's economic growth (Zamani *et al.*, 2021). The construction industry fell by 10.5% in the first quarter of 2021 to a total of RM31.4 billion (the fourth quarter of 2020: RM31.7 billion), an improvement from the -14.2% in fourth quarter of 2020 (Department of Statistics Malaysia, 2021). Although there has been an improvement in construction sector in the first quarter of 2021, the value of construction work done is still negative. Ogunnusi *et al.* (2020) point out that the COVID-19 not only affects human health, it will also affect the operation of the organization and company which also inclusive the construction industry. The COVID-19 pandemic has caused delays in construction projects. Some of the projects are being cancelled and delayed. The productivity also will be slow because the construction worker needs to follow the social distance to avoid the illness of virus. Records from the Construction Industry Development Board (CIDB) show that from January to October 2020, the value of the awarded construction projects dropped by 42 percent to RM55.3 billion, compared to RM94.6 billion in the same period last year. The happening of COVID-19 pandemic also will delay the work process because of the shortage of material (Jenn, 2020). Jenn (2020) also found that the construction projects are an activity that needs time to complete and the construction projects component and several contractual requirements will definitely be extended impacted by the shortage of labour during COVID-19.

However, in many cases, the availability of face coverings in markets and workplaces is severely insufficient. In addition, workers often forgot to bring their face coverings when they return the next day, which in many cases further exacerbates the shortage of coverings and face masks. This is the problem that emerged after the implementation of this strategy (Alsharif *et al.*, 2021). Also, the employees are overloaded and ill-equipped to deal with difficulties such as inadequate internet quality and speed, as well as internet disruptions, which have an impact on their productivity and mental health (Pamidimukkala & Kermanshachi, 2021). Besides, based on Wong (2020), believes that due to the impact of the COVID-19 pandemic, the labor shortage in the construction industry in Sarawak will further worsen. Therefore, that will cause many projects to occur delay and interruption. Based on Ogunnusi (2020), Jenn (2020), Alsharif *et al.* (2021), Pamidimukkala & Kermanshachi (2021), and Wong (2020), this research is implemented to investigate the dilemma of construction industry in Sibul Town, Sarawak from impacts of COVID-19 pandemic on construction project delay and strategies to cope with the COVID-19 pandemic among contractors.

This study focused on Sibul Town, Sarawak as the study area since the construction industry in Sibul Town had affect by the impact of COVID-19. According to Conny (2020), due to the COVID-19 pandemic, Tang, a small-time subcontractor withdrew from the construction industry Sibul Town in anticipation of zero business. In 2021, the Department of Statistics Malaysia (2021) shows that the vacancies of construction are 12.0 percent which is 21 thousand. Moreover, Lim (2020) points out that there are 11.8 percent of employees lost their job in the construction sector which is caused by the impacts of the COVID-19 pandemic. The target respondent in this study is contractors of Grade 1 who are registered with the Construction Industry Board (CIDB) of Sarawak State but a city in Sarawak, namely, Sibul Town was chosen for this study. The researcher targeted the Grade 1 contractors as the respondents for this research that is because the G1 contractors have been severely affected by the COVID-19 pandemic. The MCO has caused 10% of the 40,000 Grade 1 Bumiputera contractors to go bankrupt (Povera, 2020). This study is important to know the impacts of construction project delay due to the COVID-19 pandemic and the strategies that can implement to prevent and overcome the pandemic. This study is significant to the contractor, construction industry, government as well as students and educators. From this study, the contractor can gain knowledge about the impact of COVID-19 pandemic on construction project delay and the strategies to cope with the COVID-19 pandemic, so that they can plan and understand how best to address the impact of COVID-19 pandemic. Besides, for

the construction industry, this study can help the organizations aware of the impact of COVID-19 pandemic with the strategies and continue to work to improve the economy and unemployment will be declined.

## 2. Literature Review

### 2.1 Impacts of COVID-19 Pandemic on Construction Project Delay

The amount of COVID-19 victims is increasing every day, which also has an impact on the construction industry. Therefore, builders and government need to pay more attention to these negative effects to overcome project delays, project losses, and optimize project schedules and project performance (Esa, Ibrahim & Kamal, 2020).

#### *(a) Delays in project completion*

When the project can be delivered to the customer on time within the budget and the quality is good, the project is considered successful (Tadewos & Patel, 2018). If any delay occurs, it will lead to an extension of time and higher costs, making the project unsuccessful. MCO delayed the handover of the project to the customer, which was affected by several issues, such as delays in material supply due to the suspension of business by manufacturers and suppliers because they cannot across the state or region during MCO. Thus, the contractor needs to re-arrange the project timetable and change the work details.

#### *(b) Financial problems*

Biswas *et al.* (2021) point out that due to the company's work breakdown, the company did not have any profits. On the contrary, it caused more losses. Since the company's bankruptcy, the supply chain has been closed, and the factories producing goods have ceased production, causing many losses.

#### *(c) Human Resources*

Research of Esa *et al.* (2020) shows that human resources are also affected by the COVID-19 pandemic which includes a limited number of workers and skilled workers, allowing them to work in the same area or at the same time once in order to achieve social distancing among workers. MCO also leading to fire some unskilled workers owing to a lack of funds to hire them with no related skills.

#### *(d) Availability of resources*

During MCO, availability of resources like labor force, materials, and machinery on-site and in the market is limited, which is not only leads to time delays but also causes cost addition. According to Ramanathan *et al.* (2012), construction delays cause time and cost risks, including materials, labor force, plant and equipment, alterations, schedule, control, and government relations, which are all associated with the MCO circumstances.

#### *(e) Contractual implication issues*

All the equipment has been placed for a long time because of lockdown. These companies have signed a contract with the contractor to use all this equipment on a monetary basis. If the "force majeure" clause has alluded in the contract, the agent will not pay any compensation to the contractor caused by delay. Thus, when the contractor stops working that will cause large economic losses (Biswas *et al.*, 2021).

#### *(f) Unemployment*

Research by Biswas *et al.* (2021) shows that due to blockade, many companies are suffering huge financial losses. This is the reason that these companies cannot pay their employees correctly, and companies are laying off a few employees. As a result, many people's jobs were taken away.

*(g) Delays in material delivery*

Delay in the delivery of materials is expected to delay the progress of the entire project and cause major schedule interruptions. Delays are particularly important while the supply chain involves overseas materials or raw materials. Besides, the supplier mentioned that some truck drivers were reluctant to cross the state line because fear of contracting the virus and some states requiring quarantine for 14 days, which may also cause delays in material delivery (Alsharif *et al.*, 2021).

*(h) Material shortage*

The COVID-19 pandemic has caused thousands of companies to temporarily close assembly and manufacturing plants in China. Due to heavy reliance on parts and materials from China factories, the construction industry in Malaysia became fragile (27 Group Rebuilding Humanity, 2020). Moreover, because of lockdown, most suppliers had to close their businesses and they were unable to deliver the required materials.

*(i) Delays of inspections*

An interviewed contractor alluded that when all parties transition to a new form of work, the completion of inspections and work certification will be delayed. In many cases, due to the challenges and restrictions of face-to-face meetings, some inspection-related meetings have to be canceled and postponed (Alsharif *et al.*, 2021).

*(j) Delays of securing permits*

There are delays in obtaining permits from vary government agencies. These delays are mainly caused by the transition of government agencies to working remotely from home and the challenges related to obtaining the necessary information and documents (Alsharif *et al.*, 2021). The government agencies also do not have an efficient working system to conduct such a rapid transition.

*(k) Shortage of labor*

Because the transportation system is completely closed, workers cannot reach the workplace which leads to a shortage of labor. Workers are more likely to disseminate this disease while they contact each other, therefore many workers are unwilling to go to work (Biswas *et al.*, 2021).

## 2.2 Strategies to cope with the COVID-19 pandemic in construction industry

Although it is impossible to predict the full impact of this pandemic, construction industry contractors, subcontractors and suppliers should take the actions to better control their future when the situation begins to deteriorate. Some of the steps that should be taken immediately by the party involve in construction industry to ensure safe of work force, contract rights, and cash-flow (Moore, Seeger & Keene, 2020).

*(a) Protect The Contract Rights*

According to Moore, Seeger & Keene. (2020), the contractor must review every contract. Contractor needs to check the upstream and downstream of contract to understand how they address delays, changes, and notifications. Although the industry will argue whether any given COVID-19 related impact is a force majeure event or a contractual change, it is important that contractors must meet the contractual notice requirements immediately. There will usually result in the waiver of any right to additional time or costs if the contractor failure to do so.

*(b) Remote Working (Where Possible) With Observe Social Distancing*

During COVID-19 pandemic, social distancing measures affect regular face-to-face meetings. The company need to encourage the adoption of new communication methods of video conferencing, so the worker can work from home. Besides, some of the work such as planning or estimation, costing and designing can be done with the software at home (Biswas *et al.*, 2021). Raoufi & Fayek (2021) state that some companies are using CCTV and sensors to adapt to the distance of workers entering and leaving the job site during peak hours.

*(c) Two-meter social distancing rule*

Each section of work activity needs to be thoroughly planned to eliminate work within a distance of 2m. The workers should be side by side or back-to-back to each other, should not interact face to face. Moreover, there should also provide more ventilation in closed spaces and more intense focus on cleaning tools and surfaces (Tregartha, 2020).

*(d) Using the software applications*

The use of artificial intelligence (AI) and machine learning (ML) can make construction work easier. The employees can use the software like AutoCAD, Revit, Etabs, etc. to design at home (Biswas *et al.*, 2021). The use of software applications enabled all parties involved in the construction process to communicate as effectively as before without the need for social contact.

*(e) BIM Modelling*

Tregartha (2020) points out that modelling a site from inception to completion will better help construction planners to understand where there are opportunities to reduce social contact during the construction stage. 3D BIM modelling can help make the public spaces become more social distancing-friendly.

*(f) Closer with supplier and manufacturers*

When faced with the impact on the availability of supplies and materials, contractors and subcontractors should require suppliers to provide delivery updates frequently. There can be reduced disruption by timely identification of alternatives for materials and suppliers. Furthermore, contractors should reduce these potential impacts by maintaining continuous communication with suppliers and manufacturers (Chivilo, Fonte & Koger, 2020).

*(g) Merge together the tenders*

The tenders are merged together to account for the additional costs of the larger area required for operation due to social distance. It is suggested that plan tasks and increase program time to reduce the number of operators allowed in a certain area of the site (Tregartha, 2020).

### **3. Research Methodology**

#### **3.1 Research Design**

*(a) Research framework*

The research framework that applies to conduct this research as shown in Appendix A. There are 7 steps that conduct in this research. All of the steps generally represent overall process in the research. However, the steps that show above are not fixed as what is in the figure, it should be viewed as an ever-changing process and different research.

*(b) Research method*

This research uses quantitative method to achieves all of objectives. Quantitative as a research method that explain its findings in numbering form. Quantitative research is executed through designation of questions and surveys relevant to the set objectives of study in a form of structured questions before determine the sample of population to be participated in the event using of Krejcie and

Morgan Table. Quantitative research is a data that can be measured and can be utilize to formulate the facts and disclose patterns in the research.

*(c) Respondent*

This research used Table of Krejcie & Morgan (1970) in determining the sample size. In addition, the population in this research is the contractors who registered in Grade 1 as well as the population size, is estimated at around 319 respondents in Sibul Town, Sarawak (CIDB, 2021). Therefore, the sample size that should be taken is around 175.

*(d) Research Instrument*

The questionnaire was primarily used to evaluate the agree level of contractors to the impact of the COVID-19 pandemic on construction project delay as well as the strategies to cope with the COVID-19 pandemic in the construction industry. Likert five-point scales are used as contexts for questions, varying from strongly agree to strongly disagree. There are 3 sections which include Section A, Section B, and Section C. Section A is regarding respondent's profile. Section B is about the impact of the COVID-19 pandemic on construction project delay. Section C is regarding the perspective of contractors about the strategies to cope with the COVID-19 pandemic.

### 3.2 Pilot Study

The researcher had conducted a pilot study before performing the full study and distributing an online questionnaire to the respondents. In the pilot study, a total of 8 respondents in the Sibul Town, Sarawak have answered the online questionnaire provided. According to Bullen (2021), after the survey questionnaire design is completed, 5 to 10 respondents from the target population are selected.

*(a) Reliability Analysis*

Cronbach's alpha was used to determine the reliability of multiple-question Likert scale surveys. These questions assess latent variables, which are hidden or unobservable such as a person's conscientiousness, neurosis, or openness (Glen, 2021). George and Mallery (2003) offer the following rule of thumb: " $\alpha > 0.9$  – Excellent,  $\alpha > 0.8$  – Good,  $\alpha > 0.7$  – Acceptable,  $\alpha > 0.6$  – Questionable,  $\alpha > 0.5$  – Poor, and  $\alpha < 0.5$  – Unacceptable". According to the results of the reliability analysis on the data gathered, the Cronbach's Alpha is 0.965, as shown in Table 1, indicating that the questionnaire is reliable and the items have reasonably high internal consistency.

**Table 1: Reliability Test**

Number of Questions	Number of Respondents	Alpha Cronbach's Value
92	8	0.965

### 3.3 Data Collection

In this research, the data was collected and gathered by way of an online questionnaire distributed among 175 of Grade 1 contractors in Sibul Town, Sarawak. The questionnaire is designed online and shared in the google form. The link of google form shared on the platform such as WhatsApp.

### 3.4 Data Analysis

The collected data was analysed using Statistical Package for Social Sciences (SPSS) software. In this study, frequency analysis was used to explain the basic features of the data. A simple descriptive analysis using of mean technique was applied. The researcher used frequency to analyse the data in Sections A (demographic), B (impacts of the COVID-19 pandemic on construction project delay), and C (the strategies to cope with the COVID-19 pandemic). In this study, the researcher used the same Likert Scale in Sections B and C. These sections used the 5-point Likert Scale to evaluate the agreement

level of the Grade 1 contractors. The researcher derived the results as well as the average response (Mean) from the 5-point Likert scale.

#### 4. Results and Discussion

The results and discussion section presents data and analysis of the study. A total of 175 sets of questionnaires were distributed to the respondents. In the 175, a total of 108 sets of questionnaires were returned with answers and all of the returned questionnaires were used for data analysis purposes.

##### (a) Section A: The Background of Respondents

The section describes the sample characteristics of the typical respondents and encloses the general pattern of the responses. Besides, the table of summary of the data analysis in Section A had shown in Table 2. Most of the respondents of the study are female, representing 51.90% of all respondents. Meanwhile, the respondents who are male are 48.10%. The majority of Grade 1 contractors in Sibu Town, Sarawak are aged between 18 to 29 years old, equivalent to 50.00%. For the age category of the least respondents is 60 years and above, equivalent to 9.30%. Meanwhile, majority of respondents are Chinese at 42.60% and degree holders with highest response rates of 50.00%. The highest percentage of the respondents falls in servicing experience in between 1 to 5 years which is 52.80% of respondents.

**Table 2: Summary of Data Analysis in Section A**

No.	Background of Respondents	Frequencies	Percent (%)
1	Gender		
	Male	52	48.10
	Female	56	51.90
2	Age		
	Between 18 to 29 years old	54	50.00
	Between 30 to 49 years old	28	25.90
	Between 50 to 59 years old	16	14.80
	60 years old and above	10	9.30
3	Ethnic		
	Malay	20	18.50
	Chinese	46	42.60
	Indian	6	5.60
	Others	36	33.30
4	Highest qualifications		
	Primary/ Secondary	29	26.90
	Diploma	23	21.30
	Degree	54	50.00
	Masters/ Ph.D.	2	1.90
	Others	0	0.00
5	Years of service in the construction industry	57	52.80
	Between 1 to 5 years	16	14.80
	Between 6 to 10 years	16	14.80
	Between 11 to 20 years	19	17.60
	21 years and above		

##### (b) Section B: Impact of Covid-19 Pandemic on Construction Project Delay (Objective 1)

Based on Table 3, the majority of respondents agreed that the COVID-19 pandemic caused delays in material delivery with the highest mean value, 4.0957. Next, followed by delays in project completion, delays of inspections and material shortage which the mean value are 4.0926, 4.0911 and

4.0509 respectively. Furthermore, some of respondents agreed that the COVID-19 pandemic effected the availability of resources with a mean value of 4.0370. According to the data analysis of the returned questionnaires, the respondents also agreed that delays of securing permits (4.0370) is an impact of COVID-19 pandemic. Based on the data analysis of the questionnaires returned from respondents, the respondents agreed that the impact of COVID-19 pandemic led to unemployment (4.0154), the contractual implication issues (4.0031) and financial problems (3.9691). According to the feedback given by the respondents, they agreed that the human resources (3.9121) also effected by the COVID-19 pandemic. Lastly, the respondents agreed that the COVID-19 caused the shortage of labour with a mean value of 3.8496.

**Table 3: Mean Analysis of Impacts of COVID-19 Pandemic on Construction Project Delay**

No.	Impact	Mean	Agreement Level	Ranking
	Delays in project completion	4.0926	Agree	2
1.	Delayed handover to customer.	4.0000	Agree	4
2.	Delayed by material supply.	4.0278	Agree	3
3.	Rearrange project timetable.	4.2778	Agree	1
4.	Rearrange work details.	4.0648	Agree	2
	Financial problems	3.9691	Agree	9
5.	Companies made no profit.	3.8426	Agree	3
6.	Profits more losses.	3.8796	Agree	2
7.	Cost increase.	4.1852	Agree	1
	Human Resources	3.9121	Agree	10
8.	Limited number of unskilled	3.7778	Agree	4
9.	workers.	3.8148	Agree	3
10.	Lack of talented workers.	4.0556	Agree	1
11.	Workers work in same/time once.	4.0000	Agree	2
	Fire unskilled workers.			
	Availability of resources	4.0370	Agree	5
12.	Labour resources in limited supply.	3.9167	Agree	3
13.	Restricted of materials resources.	3.7685	Agree	5
14.	Limited machinery resource.	3.8981	Agree	4
15.	Time delays.	4.2870	Agree	2
16.	Cost addition.	4.3148	Agree	1
	Contractual implication issues	4.0031	Agree	8
17.	Equipment placed for a long time.	4.0556	Agree	2
18.	Contract contains "force majeure".	3.8889	Agree	3
19.	Economic losses.	4.0648	Agree	1
	Unemployment	4.0154	Agree	7
20.	Suffering huge financial losses.	4.0370	Agree	2
21.	Lay off some employees.	3.9444	Agree	3
22.	Employees' families have difficulties.	4.0648	Agree	1
	Delays in material delivery	4.0957	Agree	1
23.	Delay entire project progress.	4.1389	Agree	1
24.	Major schedule interruptions.	4.0556	Agree	3
25.	Delays overseas/raw materials supply chain.	4.0926	Agree	2
	Material shortage	4.0509	Agree	4
26.	Suppliers had to close their	3.9537	Agree	3
27.	businesses.	3.9352	Agree	4
28.	Social distancing caused.	4.2037	Agree	1
29.	States requiring quarantine for 14 days.	4.1111	Agree	2

Reduced labour due to isolation requirements.			
Delays of inspections	4.0911	Agree	3
30. Transition to a new form of work.	4.0185	Agree	6
31. Delayed in inspections completion.	4.1481	Agree	2
32. Delayed in finished work	4.1852	Agree	1
33. certification.	4.1019	Agree	3
34. Restrictions of face-to-face meetings.	4.0648	Agree	4
35. Inspection-related sessions cancelled.	4.0278	Agree	5
Inspection-related meetings postponed.			
Delays of securing permits	4.0370	Agree	6
36. Working remotely from home.	4.1111	Agree	1
37. Hard to get the required information.	4.0463	Agree	3
38. Difficult to obtain necessary	4.0463	Agree	3
39. documents.	3.8981	Agree	5
40. None efficient working system.	4.0833	Agree	2
Lack of technology-related support.			
Shortage of labour	3.8496	Agree	11
41. Transportation system closed.	3.7778	Agree	3
42. Workers cannot reach the workplace.	3.7500	Agree	4
43. Workers are unwilling to go to work.	3.8426	Agree	2
44. Workers disseminate the coronavirus disease.	4.0278	Agree	1

According to the analysis of the research, the main impact of the COVID-19 pandemic on construction project delay recorded as the highest mean is 4.0957 which is delays in material delivery. Therefore, the impact of COVID-19, namely delays in material delivery had caused the construction project delay. This is also acknowledged by Alsharif *et al.* (2021) where their study also stated that the delay in the delivery of the materials is expected to delay the progress of the entire project. Meanwhile, the lowest mean of the impact of COVID-19 is 3.8496, which is the shortage of labour. This is because a majority of the respondents think that the shortage of labour does not impact more in the construction project delay. Thus, with this the first objective which is to identify the impact of the COVID-19 pandemic on construction project delay has been achieved.

(c) Section C: Strategies to Cope with the COVID-19 Pandemic in Construction Industry (Objective 2)

Based on the Table 4, the majority of respondents agreed that two-meter social distancing rule is an effective strategy to cope with the COVID-19 pandemic with the highest mean value, 4.2292. Then, followed by using a BIM Modelling and protect the contract rights with the mean value which are 4.2068 and 4.1894 respectively. In addition, the respondents also agreed the strategy of closer with supplier and manufacturers and using the software applications with a mean value of 4.1821 and 4.1778 respectively. According to the results obtained from the data analyzed, the respondents agreed that merge together the tenders can reduce the impacts of COVID-19 pandemic which the mean value is 4.1551. Next, the respondents also agreed with the strategy of remote working with observe social distancing and the mean value is 4.1045.

**Table 4: Mean Analysis Strategies to Cope COVID-19 Pandemic in Construction Industry**

No.	Strategies	Mean	Agreement Level	Ranking
	Protect the contract rights	4.1894	Agree	3

1.	Must review every contract.	4.0926	Agree	11
2.	Check the upstream of contract.	4.1389	Agree	10
3.	Examine the contract's downstream.	4.1667	Agree	6
4.	Understand how the upstream address delays.	4.2407	Agree	2
5.	Recognize downstream address postpones.	4.1574	Agree	8
6.	Understand upstream address changes.	4.2130	Agree	4
7.	Learn changes addressed by downstream.	4.3519	Agree	1
8.	Understand notifications handled by upstream.	4.1389	Agree	9
9.	Recognize downstream dealt with notifications.	4.1574	Agree	7
10.	Develop timetable with upstream partners.	4.2222	Agree	3
11.	Work with downstream partners.	4.2037	Agree	5
<hr/>				
Remote working with observe social distancing		4.1045	Agree	7
12.	Adopt communication video conference.	4.2315	Agree	1
13.	Workers work from home.	3.9259	Agree	7
14.	Planning with software at home.	4.1296	Agree	4
15.	Estimation at home through the software.	4.0833	Agree	5
16.	Software allows for costing from home.	4.0463	Agree	6
17.	Designing completed at home through software.	4.1574	Agree	2
18.	Using smart technologies at the job site.	4.1574	Agree	2
<hr/>				
Two-meter social distancing rule		4.2292	Agree	1
19.	Each of work needs to thoroughly planned.	4.2870	Agree	5
20.	Decreasing the time workers.	4.1574	Agree	6
21.	Reducing frequency of close workers contact.	4.3056	Agree	4
22.	Side by side to each other.	3.9352	Agree	8
23.	Back-to-back to each other.	4.0463	Agree	7
24.	Provide more ventilation in closed spaces.	4.3426	Agree	3
25.	A greater emphasis on cleaning tools.	4.3704	Agree	2
26.	More intense focus on cleaning surfaces.	4.3889	Agree	1
<hr/>				
Using the software applications		4.1778	Agree	5
27.	Using artificial intelligence (AI).	4.2593	Agree	1
28.	Using machine learning (ML).	4.2130	Agree	4
29.	Make construction work easier.	4.2500	Agree	2
30.	Involved all parties in communicate effectively.	4.2222	Agree	3
31.	No need for social contact.	3.9444	Agree	5
<hr/>				
BIM Modelling		4.2068	Agree	2
32.	Modelling site from inception to completion.	4.2130	Agree	2
33.	Reduce social contact during construction stage.	4.1759	Agree	3
34.	Make public spaces to social distancing-friendly.	4.2315	Agree	1
<hr/>				
Closer with supplier and manufacturers		4.1821	Agree	4
35.	Require delivery frequently.	4.1759	Agree	2
36.	Timely identification.	4.1759	Agree	2
37.	Maintaining continuous communication.	4.1944	Agree	1
<hr/>				
Merge together the tenders		4.1551	Agree	6
38.	Account extra costs.	4.1759	Agree	3
39.	Plan tasks.	4.2037	Agree	1
40.	Increase programme time.	4.0370	Agree	4
41.	Reduce number of operators in a certain site.	4.2037	Agree	1

Overall, the main strategies to cope with the COVID-19 pandemic recorded as the highest mean is 4.2292 which is a two-meter social distancing rule. The respondents believe that all work task in construction site needs to follow the two-meter social distancing rule to reduce the dissemination of pandemic. This is also acknowledged by Tregartha (2020) where the research also points out that each section of work activity needs to be thoroughly planned to eliminate work within a distance of 2m. Meanwhile, the lowest mean of strategies is 4.1045 which is remote working with observed social distancing. This is due to for the construction sector, it can be said it is quite difficult to work from home. Thus, with this the second objective which is to identify the strategies to cope with the COVID-19 pandemic in the construction industry from the perspective of a contractor has been achieved.

## **5. Conclusion**

This research has shown that all the objectives of this research have been successfully accomplished through the results of data analysis gained from the returned questionnaires. Based on the research that has been done, the researcher found that the impacts of the COVID-19 pandemic on construction project delay and the strategies to cope with the COVID-19 pandemic in the construction industry were agreed upon by the Grade 1 contractors (related to Alsharef *et al.* (2021) and Tregartha (2020)). The impacts of COVID-19 can be solved by the strategies that had suggested. Therefore, the productivity in the construction industry will increase and the impacts of COVID-19 on the construction project will also be reduced. Besides, there are some recommendations for future research which are for the researcher who plans to conduct a study in this field of research, the two research methods, namely quantitative method, and qualitative method can be merged which would give a clearer insight into the research findings as well as identify the type and manner of technology that can help to increase productivity in the construction industry during the COVID-19 pandemic.

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## Appendix A

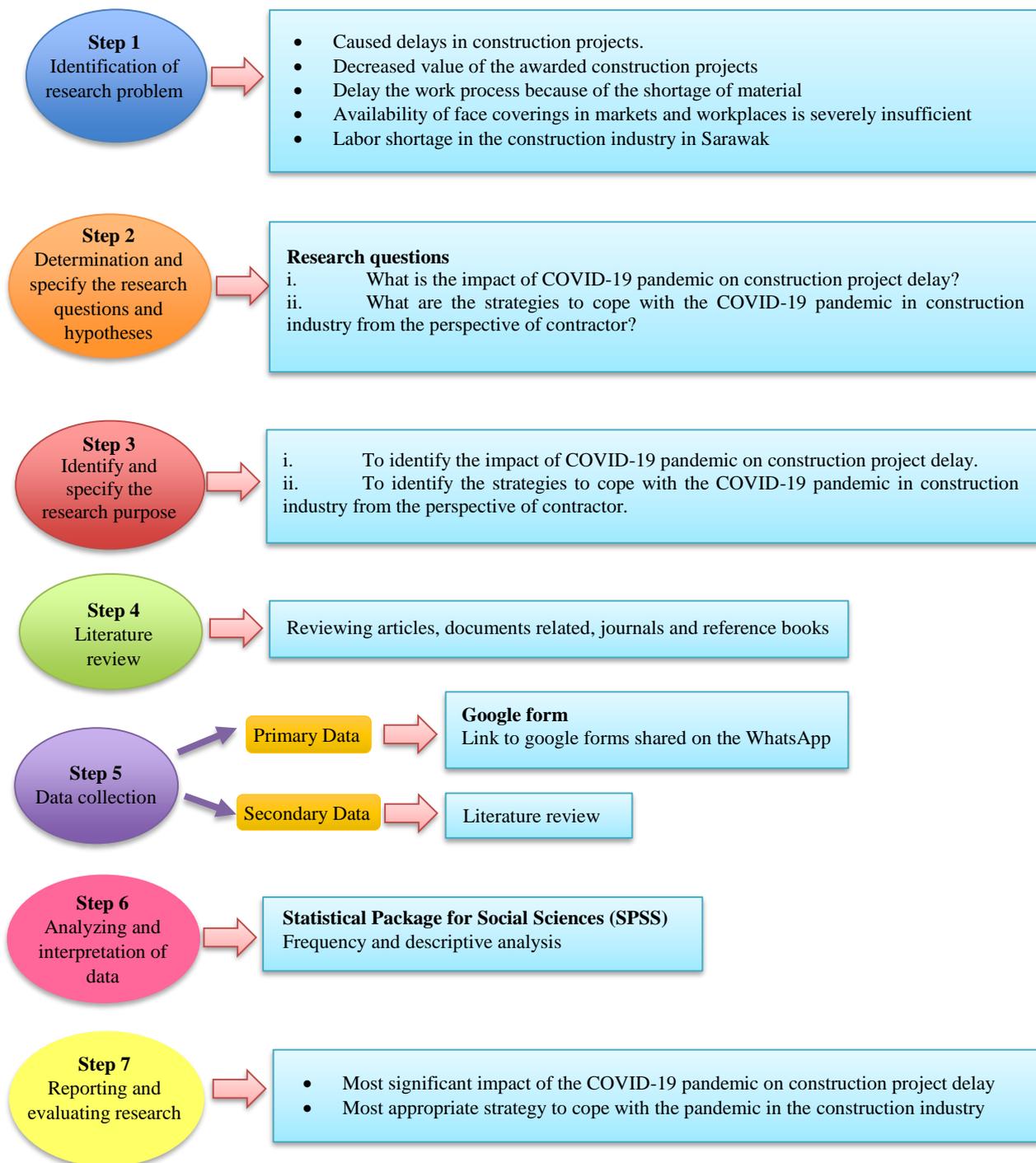


Figure 1: Research Framework