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Quantity Surveyors' Response to the COVID-19 Outbreak: A Mixed Method Approach

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ABSTRACT Since the outbreak of COVID-19 at the end of 2019, it has evolved to a pandemic that threatens the sustainability of various industries. While decisive actions have been taken to tackle the spread of this pandemic, various impacts continue to be felt by many industries including the construction industry. This paper focuses on the impact of the COVID-19 outbreak on the construction projects and the activities of Quantity Surveyors as a key profession in the construction industry. A mixed method approach was adopted to obtain the data, namely questionnaire survey followed by expert interviews. The questionnaire distribution has gained 199 valid responses for analysis using descriptive statistics and Significance Index. The qualitative data were obtained through semi-structured interviews with five experts and were analyzed using a structured thematic analysis. It was found that 56.78% of the respondents experienced project slowdowns, 13.57% experienced project suspensions or terminations, and 12.56% experienced cost overruns. Meanwhile, the Significance Index has successfully established 11 factors ranking regarding the pandemic impact on QS activities. On the other hand, qualitative findings tend to agree with the quantitative findings. These findings provide some fundamental insights regarding the impact of the COVID-19 outbreak on the construction industry including direct impacts on construction project sustainability, technology adoption, and project resiliency issues. This research also contributes to the knowledge by discussing the issues and trends of work culture changes that occur in the QS professional activities.

KEYWORDS Construction; COVID-19 impacts; Indonesia; Mixed method; Quantity surveyors.

1 INTRODUCTION

The COVID-19 pandemic which began at the end of 2019 has impacted both directly and indirectly on people around the world, including the construction community in Indonesia. Players in the construction industry are currently doing their best to accommodate these impacts and changes occurred as a result of this pandemic. Various government regulations and policies have been issued to prevent the spread of this outbreak – which unfortunately also has an impact on the construction business in Indonesia. Some of these impacts include obstruction of the supply chain and resources, quarantine of projects due to positive indications of COVID-19 cases, project delays and terminations.

On the other hand, there has not been much research related to the potential impacts, solutions and challenges of the COVID-19 outbreak on the construction industry. The published research is more related to the impact of COVID-19 in the health sector, such as publications on coronavirus, immune response, respiratory problems, and health care (Hamidah et al., 2020). Several academic publications related to COVID-19 and its impact on the construction industry include force majeure and changes in law (Hansen, 2020; Yadeta & Pandey, 2020), transportation engineering (Hendrickson & Rilett, 2020), risk communication (Oerther & Watson, 2020), and resilient cities (Chirisa et al., 2020).

In addition, there has been scarce research on the COVID-19 impacts in the Indonesian context. A bibliometric analysis of COVID-19 research found that most of the research publications were conducted by China, followed by the United States, and the United Kingdom (Hamidah et al., 2020). There are only a few studies related to the impact of COVID-19 in Indonesia (Hansen, 2020; Sarip et al., 2020; Yamali & Putri, 2020). In addition, research related to the impact of COVID-19 with a focus on QS (quantity

surveyors) perspective has not been carried out previously in the Indonesian context. Indeed, QS plays a crucial role in the construction works, especially during a pandemic time. QS, which is one of the professions in the construction industry, are experts in construction costs and contracts – which are the affected parameters of the COVID-19 in the construction industry. Delays due to the COVID-19 pandemic are likely impacted the QS activities in terms of decreased productivity and performances, delays in progress payments and disruptions of the contractual relationship between the parties involved. Therefore, this study aims to investigate the impact of the COVID-19 outbreak on the sustainability of construction projects and QS activities in Indonesia.

2 LITERATURE REVIEW

The COVID-19 outbreak has become a global disruption that has economic, environmental and social impacts (Hendrickson & Rilett, 2020). Various studies and efforts have been made to mitigate the impact of the COVID-19 outbreak, especially as have been done in the health sector (Hamidah et al., 2020). On the other hand, although the construction industry was also affected by the COVID-19 outbreak and policies taken by the government to overcome the widespread of the COVID-19 outbreak, not much research has been carried out regarding the impact of COVID-19 on the construction industry, especially in the Indonesian context.

Little of the available literature provides insight into the impact of COVID-19 on the construction industry. Ballard (2020) in Hendrickson & Rilett (2020) argues that roadways and rail transportation have further the spread of COVID-19 infection across cities and countries. Assessments on the COVID-19 impact on construction industry have been conducted in Australia (MasterBuilders, 2020), Ethiopia (Gashahun, 2020), India (KPMG, 2020), Malaysia (Gamil & Alhagar, 2020), Maldives (MNU, 2020) and Oman (Al Amri & Marey-Perez, 2020). Yadeta & Pandey (2020) analyzed the global impact of the COVID-19 pandemic on construction industry with two proposed scenarios, namely force majeure and changes in law. Similarly, Hansen (2020) has studied the impact of COVID-19 pandemic on construction contracts – whether the COVID-19 outbreak constitute a force majeure event in the Indonesian context.

To anticipate the negative effects of the COVID-19 outbreak, the governments have taken measures to curb the spread of the pandemic, including the implementation of full or partial lockdowns, border closures, limiting the public transportation system and implementation of domestic health protocols (Choudhury et al., 2020; Hansen, 2020). In Indonesia, the government has issued various regulations related to the handling of COVID-19 outbreaks in construction projects in Indonesia. Although the construction industry is one of eleven business sectors that may continue to operate during a period of large-scale social restriction (DKI Governor's Regulation No. 33 of 2020), various measures and standard health protocols must be met.

One of these measures to prevent the spread of COVID-19 outbreak on construction sites is to issue a COVID-19 prevention protocol in construction services sector through a Ministerial Instruction No. 02/IN/M/2020. This instruction provides a mechanism of the COVID-19 outbreak prevention on construction sites which includes four stages, namely establishment of a COVID-19 prevention task force, identification of the COVID-19 outbreak on sites, provision of health facilities on sites, and prevention of COVID-19 on sites. Both employers and contractors are responsible for preventing the spread of COVID-19 on construction project sites.

3 METHODS

This research adopts a mixed method approach in which the authors: (1) gather the opinions of QS professionals regarding the COVID-19 impacts towards their activities, (2) provide a validation of the gathered opinions through expert interviews, and (3) highlight fundamental insights from the findings. It includes two data collection techniques, namely: questionnaire survey and semi-structured expert interviews. Figure 1 illustrates the methodology adopted in this study.

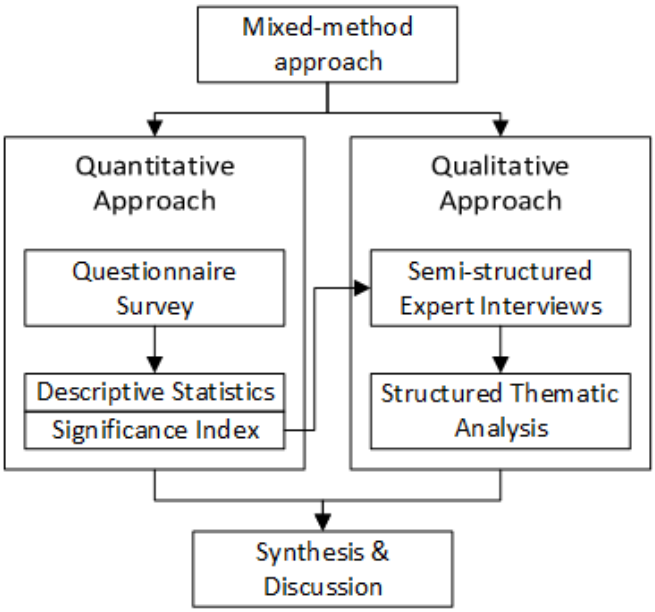

Figure 1. Research methodology.

An online questionnaire survey was distributed to QS professionals during one-month period (28 August – 27 September 2020) via Google Form. It consisted of two parts, namely: the respondent's profile and the QS response survey. In the second part of the questionnaire, a five-point Likert scale was used with '1' representing the lowest implications and '5' representing the highest implications. The obtained data was analyzed using descriptive statistics and Significance Index (*Si*). The statistical analysis consists of mean and Standard Deviation (*SD*). Mean measures the average of the numbers, while *SD* measures the amount of variation of a set of value. Si has been widely adopted for risk significance and factors ranking calculation (Zhang, 2006; Ke et al., 2009; Hansen & Rostiyanti, 2019). There are 11 items analyzed using *Si* with the following formula:

$$S_i = \frac{R_{i1}\times 20 + R_{i2}\times 40 + R_{i3}\times 60 + R_{i4}\times 80 + R_{i5}\times 100}{R_{i1}+R_{i2}+R_{i3}+R_{i4}+R_{i5}} \qquad (1)$$

Si is significance index for factor-*i*; R_{i1}, R_{i2}, R_{i3}, R_{i4}, and R_{i5} are numbers of respondents who gave responses to each scale (1 to 5) for factor-*i* respectively.

Out of 206 responses collected, only 199 are valid for analysis. Table 1 presents the surveyed respondent profiles based on the responses received. In providing responses, they were asked to make an assessment based on the last project they were working on (project profiles).

Table 1. Surveyed respondent and project profiles.

Respondent profiles	Number	%	Project profiles	Number	%
Educational background			**Project type**		
High School	6	3.02%	Airports	3	1.51%

3-year Diploma	17	8.54%	Roads	44	22.11%
Bachelor degree	140	70.35%	Buildings	127	63.82%
Master degree	32	16.08%	Factories and plants	4	2.01%
Doctoral degree	3	1.51%	Water infrastructure	3	1.51%
Others	1	0.50%	Mining	8	4.02%
Total	199	100%	Others	10	5.03%
Working experience			Total	199	100%
Less than 5 years	25	12.56%	**Project value (in IDR)**		
5 - 10 years	78	39.20%	Less than 1 Billion	16	8.04%
10-15 years	45	22.61%	1-10 Billion	34	17.09%
More than 15 years	51	25.63%	10-100 Billion	57	28.64%
Total	199	100%	More than 100 Billion	92	46.23%
Affiliation			Total	199	100%
Contractor	60	30.15%	**Duration**		
Consultant	99	49.75%	Less than 1 year	46	23.12%
Owner	25	12.56%	1-2 years	84	42.21%
Government	9	4.52%	More than 2 years	69	34.67%
Others	6	3.02%	Total	199	100%
Total	199	100%			
IQSI Member					
Yes	104	52.26%			
No	95	47.74%			
Total	199	100%			

The findings from quantitative analysis were used to develop interview questions. A total of five interviews was conducted to experts who meet the following criteria: (1) QS professionals with more than twenty years of working experience, (2) having a job position as a manager or above, and (3) representing three main stakeholders in the construction industry, namely contractors, consultants and employers. Actual interviews were conducted within nine days with the average interview duration was 31’09” and a total expert experience of 138 years.

Respondent participations are voluntary dan all interviews were recorded. A structured thematic analysis was conducted to analyze the interview data. All findings were discussed and presented in this paper without showing the personal information of expert respondents (non-identifiable data) which is not directly related to the research topic. Table 2 presents the interviewed expert profile.

Table 2. Interviewed expert profiles.

Expert	Working experience	Current affiliation	Current position	Interview duration
E1	30 years	QS Consultant	Country Director	33’08”
E2	20 years	Contractor	Commercial & Contract Manager	27’49”
E3	20 years	Owner	Project Director	30’40”
E4	37 years	QS Consultant	Company Owner	24’23”
E5	31 years	QS Consultant	President Director	39’46”

4 RESULTS

4.1 Quantitative Findings

The results of descriptive statistical analysis are presented in Figure 2 and 3. The analysis shows that 56.78% of the projects experienced a slowdown in work implementation which could lead to an extension of time. The impact of project suspensions or terminations and cost overruns contributed 13.57% and 12.56% respectively. Meanwhile, 17.09% of projects are admittedly not affected by the COVID-19 outbreak situation.

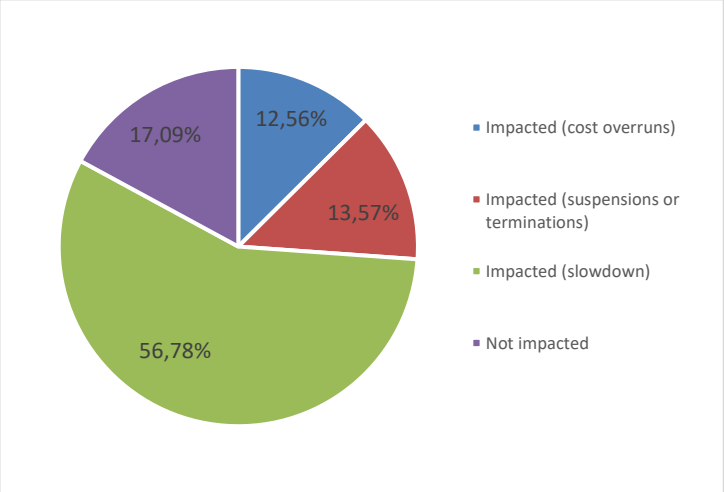

Figure 2. Project status.

Furthermore, most of the respondents also acknowledged that this pandemic had brought changes to the project (84.92%). These changes can be in the form of changes in organizational structure, work culture, application of technology, and project targets and objectives. On the other hand, 11.56% of respondents admitted that there were no significant changes that had occurred while 3.53% did not provide a clear answer.

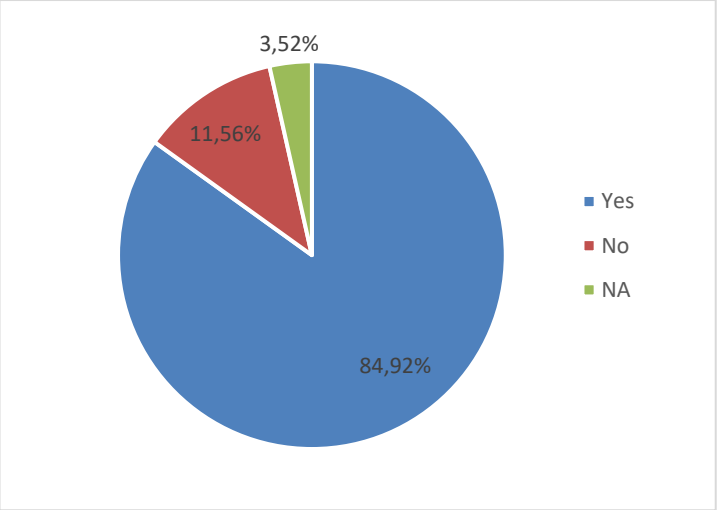

Figure 3. Change response due to COVID-19.

Meanwhile, the impact of the pandemic on various QS professional activities was analyzed using the Significance Index method as shown in Table 3. It is found that this pandemic situation has a profound impact on the overall project completion (81.71), followed by impacts on project scheduling activities

(79.40), and supply chain activities (76.68). Other QS activities follow including impacts on tendering activities (75.48), overall project cost controlling (73.27), and claim and dispute management (72.16). Meanwhile, activities related to project quality are the least impacted according to respondents with a value of 59.80.

Table 3. QS responses to COVID-19 impact.

No	Pandemic Impact Response	Mean	*SD*	*Si*	Rank
1	on the overall project schedule	4.09	0.97	81.71	1
2	on project scheduling activities	3.97	0.96	79.40	2
3	on project supply chain activities	3.83	1.03	76.68	3
4	on project tendering activities	3.77	1.01	75.48	4
5	on the overall project costs	3.66	1.08	73.27	5
6	on claim management and dispute resolution activities	3.61	1.00	72.16	6
7	on valuation activities	3.61	1.04	72.16	7
8	on contract administration and management activities	3.60	1.02	72.06	8
9	on cost estimating activities	3.58	1.06	71.66	9
10	on project team readiness and resilient	3.28	0.99	65.53	10
11	on the overall project quality	2.99	1.26	59.80	11

4.2 Qualitative Findings

The results of the above quantitative analysis were used as a basis for developing interview questions. The collected interview data were then analyzed in a structured manner based on the themes of the discussion. To make it easier to understand the findings of this interview, the key responses of these five experts are presented in Table 4 below.

Table 4. Expert interview key responses.

Questions	Key Responses
Impacts of COVID-19 to construction projects	
What are the impacts of COVID-19 to construction projects?	• While there are project slowdowns, on-going projects continue to work (E1, E4, E5) • Most of the new projects or in tendering process are being hold (E1, E4) • Decreases in productivity (E2) • Early period of pandemic in Indonesia (Mar-May'20) is the toughest (E3)
How does your company respond to the impact of COVID-19?	• Targets and goals adjustment (E1) • Negotiation between parties involved (E1) • Mapping all potential problems to anticipate early (E2) • Develops different scenarios to predict the impact of COVID-19 (E3) • Compliances with health protocols including work from home/remote working, work shift, and physical distancing (E1, E2, E3, E4, E5) • Make use of digitalization technology (E1, E2, E4, E5)
How does your company respond to the possibility of extension of time claim?	• It is a neutral event that should be negotiated between parties (E3, E4) • Requires proof regarding the impact of COVID-19 on project delays (E2) • Contractors must exercise notification procedure to inform owners regarding the potential impacts of COVID-19 (E5)
How does your company respond to the possibility of additional costs claim?	• It may increase the preliminary costs (E1, E4) • It is a neutral risk that needs to be shared and discussed between parties involved (E3, E5) • Requires proof regarding the impact of COVID-19 on project costs (E2)

What other issues have occurred as the result of COVID-19?	• Requires adjustments to changes in work culture (E2) • Some activities still have to be done on-site (E4) • Commercial issues such as shifting of spending priorities, payment delays, and discounts (E3)
Impacts of COVID-19 to QS activities and profession	
What are the impacts of COVID-19 on QS activities?	• Make use of e-tendering system or online tendering (E1, E4, E5) • Make use of technology to inspect project progress such as video inspection (E5) • Combination of remote working and on-site working (E1) • Changing of work culture from process-oriented to output-oriented (E5)
What are the difficulties of remote working?	• Connection problem (E1) • Lack of adequate supporting infrastructure (E3) • Constraints related to habits and adaptation to new things (E3) • Coordination and monitoring problems (E5)
How do you see the trend going forward?	• Difficulties in QS job opportunities due to current economic conditions (E2, E4) • Work culture changes (E1, E3, E4, E5) • There are efficiency efforts to increase company's and project's resilience (E2, E4)

5 DISCUSSION

The above quantitative and qualitative analyses provide some fundamental insights regarding the impact of the COVID-19 pandemic on construction projects and QS professional activities in Indonesia. First, it was found that most of the construction projects (82.91%) were affected as a result of the COVID-19 outbreak. These impacts can range from project slowdowns, cost overruns, to project suspensions or terminations. Similar situations also took place in other countries. In Oman, project slowdowns occurred due to a decrease in workers which reached 7.38% in the period of January - May 2020 (Al Amri & Marey-Perez, 2020). In Malaysia, the COVID-19 outbreak has entirely suspended construction projects with only a few projects are still running which are considered essential such as medical facilities expansion project to cope with the high demand for spaces (Gamil & Alhagar, 2020). Projects experiencing a slowdown due to COVID-19 are very likely to apply for an extension of time (Hansen, 2020). Meanwhile, regarding claims for additional costs due to COVID-19, negotiation and impact proving are needed by the parties involved, namely the owner, contractor and QS consultant.

On the other hand, decisions on suspensions and terminations were initiated by the owner and mutually agreed upon by the parties. In general, projects that have to be suspended or terminated are projects that have just started work on sites. There are also projects that are not affected by the pandemic situation. This may be due to various reasons, including: (1) at the start of the pandemic situation, the project was about to be completed; (2) the project had a loose time schedule so that there was sufficient float to anticipate the impact of COVID-19 regarding time aspect; and (3) the project location was in an area that is not affected by COVID-19 or is not affected by the large-scale social restrictions (PSBB) or lockdowns. Similar findings are also presented by KPMG (2020) which distinguishes the impact of COVID-19 across the project life cycle from: (1) construction works that are mostly completed or near completion have minimal impact, (2) projects under execution are negatively affected by the lockdown, (3) projects in development stage which have secured land and are about to commence execution would have to be re-estimated both from cost and time perspectives, and (4) projects in conceptual stage would be re-evaluated based on their priority.

Regarding changes, most projects (84.92%) admit that COVID-19 outbreak has brought changes in construction projects including project targets adjustment, organizational structure changes and work culture changes which currently emphasize more on the health aspects of construction workers. Compliances with health protocols were dominantly felt with the formation of COVID-19 prevention and

control teams in each construction project (Hansen, 2020). Gashahun (2020) argues that social distancing; supply of PPEs and sanitizers; alternative arrangements for transportation, facilities, working hours for staff and labor are among the possible mechanisms in construction projects to minimize the COVID-19 impact on sites. In addition, the use of QS-related digital technology is increasingly being promoted to support the physical distancing program in order to prevent the spread of COVID-19 among QS professionals.

Even though the construction industry is one of the eleven essential business sectors that is allowed to continue operating during the large-scale social restrictions period in Indonesia (DKI Governor's Regulation No. 33 of 2020), QS companies in this industry continue to make efficiency efforts to build resilience amid this pandemic situation. This can be done by reducing non-priority programs such as recruiting new QS employees, utilizing QS-related technology so that they can continue to compete, and changing the paradigm from a process-oriented to a results-oriented culture. The use of technology must be accompanied by the availability of adequate infrastructure and the readiness of QS professionals to utilize this technology. Given the large number of QS activities that can be done remotely, the orientation of activities also changed because it is not possible to monitor the process of work done by someone remotely. In other words, remote working requires a change in work culture to be results-oriented in which the performance of a QS professional is measured based on his/her work results.

6 CONCLUSION

The current COVID-19 pandemic situation has had direct and indirect impacts on the construction industry. As a result of the countermeasures carried out by the Indonesian government, the construction industry must be vigilant and alert in dealing with changes that occurred. QS as one of the important professions in this industry plays a crucial role in supporting the resilience efforts made by the key stakeholders. On the other hand, QS professionals must also be able to continue to adapt by developing their competencies in the midst of these uncertain situations.

This study has successfully examined the impact of COVID-19 outbreak on the Indonesian construction industry. These impacts can range from project slowdowns, cost overruns, to project suspensions and terminations. Furthermore, the COVID-19 outbreak has also brought changes in the industry. Change management becomes crucial during this uncertain time and may include project targets adjustment, organizational structure changes and work culture changes on project sites. From QS perspective, the outbreak of COVID-19 has led to several impacts on QS professional activities such as contractual arrangement regarding project time completion and suspension, project cost control, claim arrangement and negotiations as well as project tendering activities.

This paper contributes by reviewing the impact of the COVID-19 pandemic on the construction industry and QS professional activities in Indonesia. It has provided an empirical data to understand the current phenomena and to discuss the various impacts of the pandemic on project adjustments and QS activities. Considering that research related to the impact of the COVID-19 outbreak is still rarely carried out in the scope of the construction industry, this paper is useful by providing a basis for further research, including potential extension of time and additional costs claims, as well as work culture changes in the construction industry due to the COVID-19 outbreak.

DISCLAIMER

The authors declare no conflict of interest.

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REFERENCES

Al Amri, T. & Marey-Perez, M. 2020. Impact of Covid-19 on Oman's Construction Industry. Technium Social Sciences Journal, 9, pp. 661-670.

Chirisa, I., Mutambisi, T., Chivenge, M., Matamanda, A. R. & Ncube, R. 2020. Disaster Mitigation and Response in Cities: Drawing Lessons from COVID-19 Pandemic. *Journal of Social Sciences*, 63(1-3), pp. 21-31.

Choudhury, P. R., Ghosh, R. K. & Sindhi, S. 2020. Covid-19 crisis, pandemic resilience and linkages to land: An exposition. IIMA Working Paper WP 2020-05-01. Available at https://dx.doi.org/10.2139/ssrn.3625042.

DKI Governor's Regulation No. 33 of 2020 concerning The Implementation of Large-Scale Social Restriction in the Handling of Corona Virus Disease 2019 (COVID-19) in the Jakarta Capital City Province.

Gamil, Y. & Alhagar, A. 2020. The Impact of Pandemic Crisis on the Survival of Construction Industry: A Case of COVID-19. Mediterranean Journal of Social Sciences, 11(4), pp. 122-128.

Gashahun, A. D. 2020. Assessment on Impact of Covid-19 on Ethiopian Construction Industry. International Journal of Engineering Science and Computing, 10(7), pp. 26889-26894.

Hamidah, I., Sriyono & Hudha, M. N. 2020. A Bibliometric Analysis of Covid-19 Research using VOSviewer. *Indonesian Journal of Science & Technology*, 5(2), pp. 209-216.

Hansen, S. 2020. Does the COVID-19 Outbreak Constitute a Force Majeure Event? A Pandemic Impact on Construction Contracts. *Journal of the Civil Engineering Forum*, 6(2), pp. 201-214.

Hansen, S. & Rostiyanti, S. F. 2019. Indonesian Contractor Professionals' Perception on Problems in Construction Claim Management. *Malaysian Construction Research Journal*, 27(1), pp. 69-78.

Hendrickson, C. & Rilett, L. R. 2020. The COVID-19 Pandemic and Transportation Engineering. *Journal of Transportation Engineering, Part A: Systems*, 146(7), pp. 01820001.

Instruction of the Ministry of Public Works and Housing No. 02/IN/M/2020 concerning Protocol for Preventing the Spread of Corona Virus Disease 2019 (COVID-19) in the Construction Services.

Ke, Y., Wang, S. Q., Chan, A. P. C. & Cheung, E. 2009. Research Trend of Public-Private Partnership in Construction Journals. Journal of Construction Engineering and Management, 135(10), pp. 1076-1086.

KPMG. 2020. COVID-19: Assessment of economic impact on construction sector in India. Company report [Online] Available at: https://assets.kpmg/content/dam/kpmg/in/pdf/2020/05/covid-19-assessment-economic-impact-construction-sector.pdf [Accessed on 10 January 2021].

MasterBuilders. 2020. Impact of Covid-19 on the Building & Construction Industry. [Online] Available at: https://www.masterbuilders.com.au/getmedia/e006e78e-8c02-48b2-8d5b-7ae9519ea7c6/Impact-of-COVID-19-Survey.pdf [Accessed on 10 January 2021].

MNU (Maldives National University). 2020. The Impact of COVID-19 on the Construction Sector of the Maldives. Academic report [Online] Available at: https://mnu.edu.mv/wp-content/uploads/2016/10/THE-IMPACT-OF-COVID-19-ON-THE-CONSTRUCTION-SECTOR.pdf [Accessed on 10 January 2021].

Oerther, D. B. & Watson, R. 2020. Risk Communication is Important for Environmental Engineering during COVID-19. *Journal of Environmental Engineering*, 146(10), pp. 01820002.

Sarip, Syarifudin, A. & Muaz, A. 2020. Dampak COVID-19 Terhadap Perekonomian Masyarakat dan Pembangunan Desa. Al-Mustashfa: Jurnal Penelitian Hukum Ekonomi Islam, 5(1), pp. 10-20.

Yadeta, A. E. & Pandey, D. 2020. Analysis of the Global Impact of the Pandemic (COVID-19) on Construction Industry: Possible Scenarios. *Current Trends in Civil & Structural Engineering*, 6(4), pp. 1-8.

Yamali, F. R. & Putri, R. N. 2020. Dampak Covid-19 Terhadap Ekonomi Indonesia. Ekonomis: Journal of Economics and Business, 4(3), pp. 384-388.

Zhang, X. 2006. Public Clients' Best Value Perspectives of Public Private Partnerships in Infrastructure Development. *Journal of Construction Engineering and Management*, 132(2), pp. 107-114.