



LEEDS  
BECKETT  
UNIVERSITY

---

Citation:

Olanipekun, A and Egbelakin, T and Brudenell, TR and Omotayo, T (2022) Managing construction delivery during the COVID-19 pandemic in the UK construction industry. International Journal of Business Governance and Ethics, 1 (1). p. 1. ISSN 1477-9048 DOI: <https://doi.org/10.1504/ijbge.2022.10049842> (In Press)

Link to Leeds Beckett Repository record:

<https://eprints.leedsbeckett.ac.uk/id/eprint/8857/>

Document Version:

Article (Accepted Version)

---

Creative Commons: Attribution-No Derivative Works 4.0

© Inderscience Enterprises Ltd.

The aim of the Leeds Beckett Repository is to provide open access to our research, as required by funder policies and permitted by publishers and copyright law.

The Leeds Beckett repository holds a wide range of publications, each of which has been checked for copyright and the relevant embargo period has been applied by the Research Services team.

We operate on a standard take-down policy. If you are the author or publisher of an output and you would like it removed from the repository, please [contact us](#) and we will investigate on a case-by-case basis.

Each thesis in the repository has been cleared where necessary by the author for third party copyright. If you would like a thesis to be removed from the repository or believe there is an issue with copyright, please contact us on [openaccess@leedsbeckett.ac.uk](mailto:openaccess@leedsbeckett.ac.uk) and we will investigate on a case-by-case basis.

---

## **Managing construction delivery during the COVID-19 pandemic in the UK construction industry**

---

### **Temitope Omotayo\***

School of Built Environment Engineering and Computing,  
Leeds Beckett University,  
LS2-8AG, UK  
Email: [t.s.omotayo@leedsbeckett.ac.uk](mailto:t.s.omotayo@leedsbeckett.ac.uk)  
\*Corresponding author

### **Tom R. Brudenell**

NG Bailey,  
Unit 4 West Point Row, Great Park Road,  
Bradley Stoke, Bristol, BS32-4QG, UK  
Email: [tom.brudenell@ngbailey.co.uk](mailto:tom.brudenell@ngbailey.co.uk)

### **Ayokunle Olanipekun**

School of Built Environment,  
University of Wolverhampton,  
WV1-1LY, UK  
Email: [a.olanipekun@wlv.ac.uk](mailto:a.olanipekun@wlv.ac.uk)

### **Temitope Egbelakin**

School of Architecture and Built Environment,  
University of Newcastle,  
Callaghan, NSW 2308, Australia  
Email: [t.egbelaking@newcastle.edu.au](mailto:t.egbelaking@newcastle.edu.au)

**Abstract:** This study focused on maintaining the delivery of construction projects in a crisis scenario such as the COVID-19 pandemic to drawing construction project management lessons for future projects. A qualitative interpretive approach comprising a semi-structured interview was employed to understand the responses and strategies used by six interviewees in construction companies to maintain high productivity levels in their projects during the pandemic. Data obtained were subjected to thematic analysis to establish reoccurring strategies. The results revealed a clear disparity in the level of productivity that was achieved onsite and in the office. The UK construction industry is vulnerable to crisis, and individual organisations must build more resilience. Delays in project delivery were endemic during the peak of COVID-19, and contingency measures must be in place to bolster the efforts of onsite construction workers to meet deadlines. Finally, an extension of time due to the declaration of force majeure is not enough to support productivity.

**Keywords:** COVID-19; crisis management; disruption; productivity project delivery; the UK.

**Reference** to this paper should be made as follows: Omotayo, T., Brudenell, T.R., Olanipekun, A. and Egbelakin, T. (xxxx) 'Managing construction delivery during the COVID-19 pandemic in the UK construction industry', *Int. J. Business Governance and Ethics*, Vol. X, No. Y, pp.xxx–xxx.

**Biographical notes:** Temitope Omotayo is a Senior Lecturer in Quantity Surveyor in Quantity in the School of the Built Environment, Engineering, and Computing at Leeds Beckett University. His research interests are continuous improvement, sustainable construction and construction cost management. He recently completed a £15,000 research grant on global surveying education which was funded by the RICS/CHOBE. Currently, he is the leading investigator for an £80,000 Royal Academy of Engineering Grant.

Tom R. Brudenell is a Senior Quantity Surveyor Engineering South West Wales, with the NG Bailey, Bristol, UK. He is a member of the Royal Institute of Quantity Surveyors and has had experience as a commercial manager on various construction projects. He received his MSc in Quantity Surveying and Commercial Management from the Leeds Beckett University. In his MSc dissertation, he studied the impact of COVID-19 on project delivery and the outcome of this dissertation informed this research.

Ayokunle Olanipekun has published widely in the areas of sustainable construction, green construction and buildings, corporate social responsibility and construction management. He has a Post-doctoral and PhD qualification in Construction Project Management and Quantity Surveying related disciplines from the Massey University, New Zealand and Queensland University of Technology, Australia.

Temitope Egbelakin is an Associate Professor and Director of Disaster Resilience and Sustainable Future in the University of Newcastle, Australia. He worked on translational research in New Zealand and Australia with impact on empowering individuals, governments, businesses and local communities to implement the Sendia framework for disaster risk reduction, UN SDGs and 2030 Agenda.

---

## 1 Introduction

Over the last century, the construction industry has been the victim of many economic crises. The Great Depression of the late 1920s and early 1930s and seven further recessions from 1956 to 2008 saw enormous hardship hit the British economy (Lawson, 2020). Since March 2020, the UK has found itself in the throes of a global pandemic (Asis, 2020; Koh, 2020). The COVID-19 pandemic has changed how work is done, and organisations have adopted more flexible working options.

COVID-19 is an example of a crisis in construction. From a generic viewpoint, COVID-19 was a sudden and unexpected event that threatened to disrupt an organisation's operations and posed both a financial and a reputational threat (Ogunnusi et al., 2021). Lerbinger (1997) described crisis management as an event that brings or has the potential to bring an organisation into disrepute and imperils its future profitability,

growth and overall survival' (Lerbinger, 1997). Reid considers multiple definitions before settling on any incident that can focus negative attention on a company and harm its overall financial condition, relationships with its audiences, or relationships with its marketplace (Reid, 2000). In the construction and project planning context, Loosemore (1999), Reid (2000), Lerbinger (1997), Hallgren and Wilson (2008), Kaklauskas et al. (2011), and Srinivasan and Nandhini (2015) have all studied crisis management extensively, offering multiple viewpoints on how the industry copes in a crisis. COVID-19 epidemic is another form of crisis that affected the construction industry. Consequently, the significant impact of COVID-19 on construction output in the UK, just like every other country in the world, bothers around the idea of productivity (Ogunnusi et al., 2021).

According to Biswas et al. (2021), the UK gross domestic product (GDP) contracted by 5.8% as of March 2020 when COVID-19 restrictions were effected. The UK construction industry contributes 6% to the GDP, and during the COVID-19 pandemic, the industry lost £301.5 million per day. The problems surrounding the issue of COVID-19 and productivity do not stop at just a depleted workforce. One could argue that the effects are felt throughout the entire supply chain, with many projects relying on materials from overseas. The situation in one country may not be the same as that in another, and materials from a 'locked-down' country may not reach one with less draconian measures to meet key program dates.

An early-stage response to this concern has been ensuring a large supply chain and multiple sources of materials in case supply lines are suddenly cut-off at crucial stages of project delivery (Goodman, 2020a). With more specialist materials now coming from abroad, it seems inevitable that some project delays will be attributable to this. The industry cannot ignore the impact of this now and on productivity (Alenezi, 2020). With little contractual protection, and inconsistent workforce unable to meet program demands, and an unreliable supply chain, how deeply is the impact being felt within individual stakeholders' businesses? With organisations facing so many COVID-19 related risks, how can disruption be minimised and mitigated?

This research will address how organisations manage productivity and protect themselves commercially from the pitfalls of this crisis in a live and ever-changing situation. It will assess whether the UK construction industry needs to be more resilient to weather such difficult times in future and whether another national health crisis or prolongation of this one will have more severe repercussions on the industry than we are currently observing. Finally, this study provides an insight into the impact COVID-19 has on construction productivity in the UK.

## **2 Literature review**

COVID-19 impacted the construction industry in terms of measures taken during lockdown to maintain productivity, which resonates clearly with the goals of this study. UK construction activities at the peak of COVID-19 restriction moved slower, and delays were frequent and caused by multiple parties, including subcontractors, main contractors, and suppliers (Suresh et al., 2020). Suresh et al. (2020) noted the five 'C' that can mitigate the impact of COVID-19 on construction activities; these are labelled as 'create culture, control systems, courageous decisions, combat mental health and care for employees' (Suresh et al., 2020).

The measures in place to stop the spread of COVID-19 in the UK were working from home, furlough, and reduced labour numbers on site have been the cause of delay on many projects (Jallow et al., 2020).

Further detailing site-specific constraints such as issues with site instructions due to being unable to effectively carry out routine drugs and alcohol testing and additional problems with holding meetings. However, solutions to the latter point have appeared in video conferencing and utilising the BIM model to illustrate agenda items relating to building specifics. Stiles et al. (2021) note that although construction has been hit hard by the pandemic, it is also key to the economy's recovery. They note that the industry's great importance in the recovery process means it does not have the luxury of fully shutting down. Construction in the UK must continue and adapt its many varied working environments to be 'COVID-safe'. Many new health and safety and general working practices have been implemented onsite and maintain productivity (Stiles et al., 2021). The behaviour of the construction industry in periods of crisis has been the focal point of multiple studies, and this will be highlighted for the inferential purposes of this study.

### *2.1 Crisis management in the construction industry*

Loosemore (1999) evidenced crisis management theories with case studies observing how an initial human reaction is often emotional and self-preserving before logical and pragmatic. Loosemore (1999) further observed the steps taken to reach a productive solution from an often counter-productive initial response. These steps are like Hallgren and Wilson's (2008) suggestion on projects as a practice approach, observing different types of crises across different types of projects and how each is managed, specifically identifying two crisis handling factions within an organisation. A formal crisis team was recommended to handle sudden events. The operational project team was informally handling 'cumulative' crises onsite, and often without the involvement of a more corporate function (Hallgren and Wilson, 2008). Hallgren and Wilson (2008) also note the emphasis placed on crisis prevention.

Pandemics can affect the direct labour force in the construction industry. For instance, COVID-19 has led to the hospitalisation of many construction workers (Asis, 2020; Koh, 2020). With many implementing work-from-home policies and having to furlough staff members to adhere to distancing guidelines and ease the economic burden of the downturn. Designated by Boris Johnson and the Conservative Government as an 'essential' industry and manufacturing, construction must continue and must do so whilst adhering to the guidelines. Although unprecedented in the UK in recent times, this is not the first time the world experienced a pandemic. The SARS and MERS outbreaks of 2002 and 2012 demonstrated the damage a virus can do to the economy by disrupting supply chains, travel, imports, and exports and shutting down manufacturing industries where large personnel mix in proximity (Goodman, 2020b). The COVID-19 pandemic manifests itself as more damaging and far-reaching to the construction industry than historic pandemics.

During the first UK lockdown of March 2020, the crisis forced sites to close temporarily in Scotland. In 2021, it continues to stall the commencement of major projects, having a knock-on effect on builders, contractors, and other stakeholders to the extent that the industry has now seen job losses on an enormous scale (Biswas et al., 2021). Despite the government offering bailout packages to small and medium-sized businesses, the furlough scheme offers security and a safety net for millions of employed

people (Jallow et al., 2020; Biswas et al., 2021). The landscape has changed on construction sites that are still open and functioning. Scotland aside, with the UK Government not specifically mandating construction sites to close, organisations are tasked with managing the ongoing crisis and ensuring continuous project delivery on their own. Construction organisations face difficult choices; maintaining social distancing, implementing sanitation procedures, and the use of ‘track and trace’ all come at a cost. This cost is not only a direct financial one but also a drop in productivity resulting in contractual disputes and delays in project delivery (Araya, 2020).

Further, with the government directing that anyone exhibiting COVID-19 symptoms must isolate at home for up to two weeks, the labour workforce will be smaller than forecasted, and extension of time requests may become far more commonplace than in previous years.

## *2.2 The impact of COVID-19 on construction planning and productivity*

Productivity problems are experienced throughout the entire supply chain, with many projects relying on materials from overseas. COVID-19 has reduced the productivity of construction workers since its inception (Boamah et al., 2022; Umar, 2022). Furthermore, in terms of construction organisation resilience, Chih et al. (2022) suggested short and long-term planning for all eventualities. An early-stage response to this concern has been ensuring a large supply chain and multiple sources of materials in case supply lines are suddenly cut off at crucial stages of project delivery. (Boamah et al., 2022). Sahin et al. (2015) take a similar approach to Hallgren and Wilson (2008), suggesting that prior planning is the key to managing a crisis successfully. The authors note five distinct approaches to crisis management – escaping, solving, proactive, reactive, and interactive (Sahin et al., 2015). The proactive approach is specifically concerned with establishing early warning systems, ensuring adequate training, forming crisis prevention teams in preparation, and arguably being the choice approach when given the benefit of hindsight.

They note it is often the reactive approach most frequently adopted when a business faces an unforeseeable and unprecedented event, COVID-19, for example, and this approach is often the most counter-productive. They conclude that to overcome a crisis, an organisation must be proactive in preventing it or being prepared to mitigate its effects before it happens (Sahin et al., 2015). Janine Reid similarly found that the chances of managing a crisis increase exponentially in line with the amount of planning and preparation done beforehand (Reid, 2000). The effort in preparing for a crisis may be the difference between a business surviving such an event or not. Gunning and Hanna (2001) argued that a contractor might begin to feasibly prepare at the tender stage by having the foresight to identify potential crises as risks and making suitable allowance in the cost plan to cover unforeseeable events (Gunning and Hanna, 2001).

Gunning and Hanna (2001) distinguishes between a crisis and an un-assessed risk, albeit admitting it is not necessarily a clear one. The latter is the retrospective analysis of the cause of the crisis as being preventable. The former is, for example, when a contractor fails to predict the out come of any risk event correctly, thereby becoming a crisis. With organisations generally lacking in adopting flexible responses to crises, Zhong and Low (2009) developed a model for a flexible and complex response suitable for continuously changing situations.

Vondruska (2014) detailed the effects on a large construction project and identified principles of communication and levels and owners of responsibilities in a crisis. The

study concluded that the quality of communication between project management teams and their clients and other stakeholders remains the most important factor in keeping project progress flowing during testing times. Dainty et al. (2007) also argues that coordination is key to public health. Coordinating all parties effectively through efficient communication channels is one strategy for overcoming the event. Within construction, lines of communication governing the program, procurement of materials, and management of labour resources are exceptionally diverse given the large numbers of parties involved.

### *2.3 Construction labour productivity, force Majeure, and COVID-19*

Labour productivity must be constantly monitored to effectively manage the labour budget. Ultimately, good labour productivity in the construction industry is key to delivering projects on time, but it is also a commercial issue. Anyone who has ever taken a car into a garage will attest that labour is expensive (Omotayo et al., 2019, 2020; Ogunnusi et al., 2021). It is a particularly costly commodity when the output is less than expected due to operating non-productively (Omotayo et al., 2022). Good labour productivity allows contractors to be competitive and meet their goal of achieving value for money and meeting the client's budget expectations (Shashank et al., 2014). The labour cost of a construction project varies but is typically between 25% and 40% of the overall build cost. Unproductive labour is one of the biggest reasons for overspending on construction projects. With such a high capital value invested, it often leads to claims between parties to a contract, should one be culpable for poor productivity, which leaves the other out of pocket.

This study focused on the principle of force majeure in contractual terms. Nor will it focus on the various documented discussions over its legal definition, use, or any disputes over what generally constitutes a force majeure event. However, it must be discussed as a potential remedy for organisations suffering from poor productivity because of COVID-19. Particularly in standard form contracts, such as joint contract tribunal (JCT). Here, one can theoretically find a reasonably clear route to recovering time lost because of the pandemic under Section 2 as a 'relevant event', provided the pandemic can be categorised and agreed by all contracting parties as a force majeure event. Casady and Baxter (2020) noted Loosemore's three ironies of crisis management in construction projects and called for a re-structure of force majeure clauses in general and protect against similar crises to the one currently faced. Effective crisis management is achieved through planning and preparation. Risk analyses can ensure suitable contingency is built into construction project tenders to avoid financial loss. Crisis management teams and specific procedures can be assembled to deal with the unforeseeable. Construction organisations can be their own worst enemy when dealing with a crisis. Communication, coordination, planning and preparing for the worst are crucial in fostering resilient construction organisations.

## **3 Materials and methods**

Qualitative research emphasises exploring and understanding a phenomenon outside existing knowledge by looking at the meaning ascribed to crisis management by project team members affected by the COVID-19 pandemic to produce meaningful conclusions

(Creswell, 2014). Also, it is for this reason that a quantitative research methodology has been ruled out. Here, the focus lies in understanding and presenting data gathered in interview form from six participants using the purposive sampling technique. The data was analysed for consistency and common themes. The study presented findings based mainly on construction professionals' thoughts, opinions, and actions who experienced the challenges of working in COVID-19. The saturation point was reached whilst interviewing the respondents, which limited the responses to six interviews. Before arriving at the saturation point, the targeted sample size of the study was (30) interviewees. However, during the data collection phase of the study, most interviewees did not respond to the request for an interview due to the dynamic nature of the construction industry.

Notwithstanding, the saturation point in the interview process is attained when the same responses are repeated consistently, thus making further responses redundant (Weller et al., 2018). The six interviewees provided repetitive and similar answers during the data collection process.

Therefore, data collection had to stop at this sample size. The purposive sampling technique was used to select the participants with the right expertise (Omotayo et al., 2019; Iheukwumere et al., 2021).

Furthermore, while seeking to present original ideas, this study explored some of the key ideas and theories in the existing relevant literature. An example of this is Loosemore (1999)'s 'three ironies of crisis management. It is an interpretive approach that helps understand and investigate how the behavioural response can be between irrational and counter-productive and measured and efficient. Data has been solely obtained from the words of human participants. The study investigates the effects on productivity on an organisational and individual level, as discussed in Sections 2.2 and 2.3, and any resulting disruption in the supply chain of construction materials and contractual disputes. This type of information must be acquired from people's experiences. The data collection employed semi-structured interviews. The interview sheets were structured into a sequence of twelve questions, designed to extract information from the participants in several areas:

- The effect of the pandemic on individual productivity.
- Their organisation's ability to remain productive and adapt to new regulations.
- How contractual performance has been managed, disrupted, or frustrated.
- The impact on the organisations' supply chain productivity.

All six interviewees are based in the UK and work for either main contractors or subcontractors within the UK construction industry. This study targeted participants involved in projects at different stages of construction to understand their responses as the project progressed.

### *3.1 Data collection and participant's profile*

The participants have been recruited by email, with invitations sent to each target participant with a description of the study and detail on how and where the findings will be used. Consent forms were also produced and distributed to all participants willing to participate following positive responses to invitations. Data was collected in the form of



written notes and transcriptions taken by the author from the participants' answers to questions relating to the effect of COVID-19 on productivity, as described above. The interviews were undertaken using video conferencing software, recorded to allow further review and transcription, and each lasted around thirty minutes. Only the author and the participant were present at each interview, and only the author will be entitled to review the recorded material.

The six participants engaged in varying roles within their organisations and were involved in different projects. This provided a broad insight from a small sample and ensured differing perspectives when answering the questions. Table 1 outlines the profile of the interviewees.

**Table 1** Background of interviewees

<i>Nr.</i>	<i>Interviewee</i>	<i>Interviewee code</i>	<i>Contractor/consultant</i>	<i>Current project</i>
1	Project manager	PM	Contractor	Hospital construction project
2	Quantity surveyor	QS1	Contractor	New-build housing development
3	Quantity surveyor	QS2	Contractor	University building and police station
4	Planner	PL	Consultant	Commercial building
5	Mechanical supervisor	MS	Contractor	Refurbishment of a university building
6.	Electrical engineer	EE	Contractor	Hospitality and education buildings

The project manager (PM) is employed by a large services contractor and leads a major hospital construction project. Quantity surveyor 1 (QS1) works with one of the UK's largest house builders and is responsible for commercially managing a new-build housing development. The abovementioned participants were selected for the study because they represent the broad sector of construction professions in the construction industry. For instance, PM and PL represent the planning teams, and QS is involved in cost planning. PM, MS and EE are involved in design and implementation.

Quantity surveyor 2 (QS2) is employed by a mechanical and electrical subcontractor. QS2 is currently commercially managing a university campus and a police station. A large services contractor employed the planner (PL), working on four commercial new build projects. MA mechanical supervisor (MS) acts as a mechanical and electrical services contractor and supervises the mechanical installation packages on a refurbishment project for a university. The main contractor employed electrical engineer (EE) and worked on multiple large projects within the hospitality and education sector.

## **4 Analysis and results**

The interviews were structured as twelve questions specifically aimed at understanding how the pandemic has impacted and continues to impact the productivity of a small number of individuals in varied roles in the construction industry. Each interview followed the same structure and lasted approximately thirty minutes. The first five minutes were used for the author to introduce the topic and revisit the participant information sheet and consent form to ensure the interviewees were clear on the details. All interviewees were briefed once again at the start of each interview and reminded that they were under no obligation to participate. Any data collected was solely for this research project and was to be deleted upon completing the transcripts.

### *4.1 Thematic analysis, categorisation, and coding*

The following steps have been followed to achieve thematic analysis, categorisation, and coding. The first step in understanding the data is to sort the data. The author completed an interview record sheet containing a text box summary per interview. These documents aimed to provide a paragraph for each question that accurately captured the interviewee's response. Therefore, the transcriptions were repeatedly reviewed, studied, and summarised to capture the views and opinions of the participants as they presented themselves. See appendices.

In terms of coding, a straightforward method was utilised. Charmaz (2014) and Zhang and Wildemuth (2009) proposed the constant comparison coding method to analyse this type of raw data. There are two facets to employing this method: systematically comparing texts assigned to categories and integrating categories and their properties using interpretive memos to derive the themes (Charmaz, 2014; Zhangs and Wildemuth 2009). Considering

this approach and keeping the coding of data simple, three tables have been produced to identify and categorise the main thoughts and themes raised in the interviews. Appendix (please refer to Appendix for the comprehensive analysis) is driven by the interview questions and captures the main themes and ideas with the individual questions as group headings.

The 12 questions are listed in table form, with the most common or reoccurring themes identified. Also noted in brackets are the specific participants who raised the points.

Table 2 presented the thematic analysis of each response, and Table 3 provided a comparative response from the interviewees on how site and office-based construction workers view productivity. The semi-structured interviews reveal several ideas and themes. The questions encouraged honest answers and yielded mixed responses. Some revealed a stark contrast in personal experience seemingly governed by the exact job roles of the participants, whilst others identified common reoccurring themes.



**Table 3** Comparative findings of the site and office-based construction workers

<i>Site-based</i>	<i>Office-based</i>
Experiencing reduced productivity	Experiencing increased productivity
Unable to manage workload	Managing workload effectively
Does not feel safe at work	Feels safe at work
Hindered by new procedures	Helped by new procedures
Output is reduced in many cases	Output is increased in many cases
Emphasis on maintaining relationships and working together	Emphasis on cost control and maximising entitlement for delay

## 5 Discussion of findings

Six theme categories have emerged from the data, explored below within Sections 5.1–5.6. In Section 5.7, a brief hypothetical summary has been produced to determine how the participants' organisations may have improved their managing of productivity with the benefit of the data gathered by this study.

### 5.1 *Conflicting responses to the pandemic resulting from government guidance*

The first response to the pandemic was different for all organisations and all job groups within each organisation. For example, QS1 did not experience the same level of disruption as was felt by QS2, stating but had experienced no negative effects regarding productivity. QS2, on the other hand, cited difficulties in communicating with other parties as a major factor for why his productivity was being disrupted. Similarly, the participants spoke of poor productivity within their supply chains. Initially, PM experienced great difficulty ensuring adequate labour resources attended the site as required by the construction program. At some point in the interview, all participants mention the government's vague guidelines for the construction industry, which has impacted different companies' responses. Had the government been clear on the matter, one would expect a uniform response across the industry. However, the opposite is true.

PM's organisation handled the initial impact calmly. It did not make any redundancies, instead of holding on to all staff and ensuring there was enough resource onsite to handle any disruptive impact to progress. In contrast, MS and PL noted their organisations over-reacted initially with a swathe of redundancies which now appears to have been, at least in part, a poor decision due to their increased and often unmanageable workload. MS was going as far as to call the redundancies a '*knee-jerk reaction*', supporting Sahin et al. (2015)'s assertions of they are active crisis management approach'. The action was now proving to be premature as MS and PL described an unmanageably large workload, and QS2 stated he is now doing the job of two people, again due to redundancies. Indeed, this response also endorses Loosemore's (1999) theory that a crisis's initial reaction is often emotional and self-preserving rather than logical and pragmatic (Loosemore, 1999). We see the participants describing a chaotic first response, with PL, EE and MS describing their companies as making what they now deem to be bad business decisions. Particularly, the attempts to maintain 'business as usual' onsite despite the health risks (EE and PL), with MS stating:

“Nothing has changed. The business still expects us to be as productive as before.”

This statement may go some way to demonstrating Loose more and Hughes’ idea that some businesses manage crises in a way that prioritises economic survival over everything else. These businesses continued to operate at pre-crisis levels and only adapted to maintain the most profitable course under the circumstances. If this is at the detriment of other factors, be it social, environmental, political, or other, then that is deemed acceptable provided that the commercial impact is kept to a minimum (Loosemore, 1998). PL expresses a similar view and goes a step further, commenting that his organisation has still not changed its approach to managing productivity one year on and maintains unrealistic expectations of how productively the site teams can work.

The perceived poor business decisions extend internally within the organisations, with QS1 using the word ‘*chaotic*’ to describe his organisation’s response. Another business to act hastily, QS1’s organisation effectively shut down operations whilst the impact of the crisis was understood. Measured and effective decisions did not follow for some time, with the company, a housing developer, now operating a successful work from home policy and planning to re-commence postponed projects. Had the much-documented crisis management theories and warnings surrounding the idea that prevention is better than cure, such as those of Sahin et al. (2015), been heeded. One could argue that the period of low productivity could have been some what mitigated.

Sahin et al. (2015) and Reid (2000) both argue that proper planning and prevention are the keys to overcoming crises swiftly. With a continued delay, a year from the first outbreak, and the issues present internally within the organisations, it is abundantly clear that the construction industry was unprepared for such an impactful public health crisis. The data collected for this study suggests that Sahin et al. (2015) and Reid (2000) were correct in their findings. EE comments that the participants’ organisations all had no plan for the drop in productivity, instead of having to ‘*think on their feet*’. Further, the crisis teams Hallgren et al. (2008) observed with their research have not been present here. A dedicated crisis management team may be classed as an expensive and non-essential luxury in an industry of often high volume and low margins.

## 5.2 *Adapting to change*

Following the initial impact of the crisis on the construction industry, the participants of this research had to adapt to new ways of working and managing productivity. A reoccurring theme present in the data is that of adaptation. All participants acknowledged that their organisations had adapted to some extent. However, it was apparent that some had adapted quicker than others. The uncertainty surrounding the duration of the pandemic, the furlough scheme, the individual projects’ programs, and the available contractual protection meant the participants’ organisations were, in many cases reacting instead of pro acting. The data reveals that the approach taken by all organisations is based upon strict adherence to the government’s guidelines, particularly in the office environment. 100% of interviewees stated their organisations were following the guidelines and had done from the first lockdown. 50% said the new procedures had been implemented quickly. Others stated there was a delay where management reacted and demonstrated how unprepared they were to deal with such a drastic change to the normal way of working.

The findings are synonymous with those of Suresh et al. (2020). Suresh et al. (2020) are participants generally observed their organisations and those of their supply chain, taking considerable time to adapt and put measures. Consequently, delays were frequent. Similarly, evidence of delay attributable to COVID-19 impacted low productivity is found in the data. A mixed response was received as to how well the participants felt their organisations had adapted to the ever-changing situation in terms of adaptation. Although most believed there had been an improvement between the initial lockdown of March 2020 and the third lockdown of January 2021.

MS stated that “there was much uncertainty on how best to manage and approach the pandemic in the workplace due to the limited guidance available. The organisation is now better prepared to manage productivity.”

A similar response was received by PL, although they believed the improvement over time was minimal: (the response to the latest lockdown has been) “more or less the same as the first one, although site procedures have become more streamlined.”

PM’s organisation has adopted a proactive approach:

“As we have become accustomed to this way of life, we have developed processes for managing productivity and health and safety, so It has been easier. We have also tried to avoid unnecessary COVID-19 precautions to prevent further loss of productivity.”

The responses were unanimous when questioned about whether any processes or practices would remain after the pandemic. Video conferencing would stay with three site-based and three office-based interviewees, all in recognition of how effective Microsoft Teams and other similar platforms are at boosting productivity.

The congruent responses continued when asked about working from home. QS1 opined:

“The business has realised it can get the same productivity from employees without making us come into the office each day.”

A view shared by QS2, PL and PM. PL’s response to the same question was:

“Home working part of the week and using (Microsoft) teams for meetings will stay. Saves on travel time and means I can be more productive during the day. Nothing on site will continue as all the COVID-19 processes introduced are hindering the guys more than anything.”

Despite the challenges and severe detrimental effects to productivity regarding delivering projects at the site level, organisations are adapting and, in doing so, are discovering ways of improving productivity in other areas. A speculative view of the future could be that when the construction industry has re-stabilised, and the pandemic is over, it will be more productive than before.

### *5.3 Office vs. site*

One clear outcome of the research is the difference between how the pandemic has been handled within office environments and onsite. Conflicting accounts of this are evident in the data, and it can be argued that the views of office-based and site-based interviewees are divided based on the interviewee’s primary place of work.

When discussing the effect on construction site management, the participants’ responses do not suggest that their organisations have done more than the government

required them. QS1, QS2, and PL have stated that their companies have done all to keep them safe. The site-based participants, PM, EE, and MS have also observed this when discussing how their office-based colleagues have been impacted. We have not seen mass protests of construction workers or industrial action. The news coverage centres only on the importance of the industry in keeping the economy going. A feeling of resentment against the government's unclear guidelines for the construction industry is apparent in the responses. PM, EE, and MS often mention that they feel their health is being put at risk by coming to work each day. EE specifically mentions the vague Government rules about construction sites and goes on to state that he believes that site workers are: "...made to feel less important than everyone else", further stating: "It is ok to sacrifice a few construction workers to keep the economy going."

EE's responses, echoed by MS and PL, centre around the general feeling onsite that the site management and the government will turn a blind eye to clear breaches of COVID-19 safety guidelines to achieve acceptable levels of productivity on their sites. Conversely, the office-based interviewees do not mention feelings of concern for their health at any point. Their productivity, disrupted whilst new processes are implemented, appears to have improved in areas. The responses of QS1 and QS2 support this idea. QS2 opined that: "...due to colleagues working from home, my productivity has arguably increased as there are fewer distractions when working in the office". QS2 was given the option to work from home. However, ultimately decided that they would be far more productive working from the office. The reduced staff levels mitigate the concerns over infection. QS1 was given the option to work from home and took it.

"As a QS, I can work from home a lot of the time, so I am now spending the time I spent previously commuting more productively."

This is echoed by PL, who, as a planner, is not directly responsible for delivering projects but undertakes a supporting role. As such, they too were given the option to work from home and found that they experienced increased productivity as fewer distractions and less time spent travelling to and from meetings or to the office. The data suggests a disparity between how productivity has suffered onsite and in the office. The office-based participants (QS1, QS2, PL) report improved productivity enabled by home working and video conferencing. The site-based participants (PM, EE, MS) report the exact opposite, with new processes, adhering to Government guidelines, difficulty obtaining materials, and managing staff absence noted as the most prevalent issues.

#### *5.4 Managing delays collaboratively and productivity*

PM, EE, and PL have all experienced delay and disruption to their projects but speak of a collaborative approach between their organisations, the client's project team and the main contractor. The incumbent crisis impacts all stakeholders in a project. The emerging theme from the participants is that whilst there are legitimate grounds for pursuing claims based on the lack of contractual protection afforded to parties in these circumstances, it is not necessarily the best course of action. No organisation is immune from the inevitable due to the human element, and crises do not discriminate (Reid, 2000). Crises as unimaginable and impossible to prevent (Lagadec, 1997). With the uncertainty over which parties would fowl of the COVID-19 crisis, the participants' organisations and their clients and supply chain have taken the view that it is better to work together. The data

reveals that stakeholders are making allowances for each other's misfortune at the hands of the pandemic in many circumstances.

PM believes that the 'tit-for-tat' approach is being avoided on his project. The reason is that, on one day, his team would be able to 'hit the builder with delay charges'. On another day, this approach could 'come back to bite' them, as inevitably, they would fall behind because of self-isolating operatives.

Hallgren and Wilson (2008) theorised that the adversarial nature of the construction industry does not allow collaborative working in a crisis can be challenged here. It could be argued that unilateral delays resulting from crises could stimulate disputes and a confrontational approach to managing delays.

However, this specific category of crisis, a public health crisis, has created a level playing field for all stakeholders. With 100% of interviewees agreeing that their projects have been delayed or disrupted in some capacity by COVID-19 and 50% describing a situation where the whole supply chain is working collaboratively, this notion of Hallgren and Wilson (2008)'s findings does not apply to public health crises. It would therefore appear to be supported with evidence.

The idea that COVID-19 related delay is unavoidable and cannot be prevented is a common theme throughout the interviews. EE states: "We have had to start thinking outside the box and learning to work together where previously us and the builder would have been building claims against each other". PM says, "PMs get bombarded from all angles at the best of times. Managing COVID-19 on top of the daily tasks is hard work, and stuff is not done. Things get missed, and it feels like there is nothing we can do about it."

EE describes how the best management strategy for reducing productivity has been 'all parties coming to the table and holding daily strategy meetings'. Again, and in support of Reid's (2000) and Lagadec's (1997) arguments, one could interpret from this statement that crisis management is more effective when all parties are working together. MS describes disruption and re-sequencing of program activities on their project. Still, she comments that no party has taken no contractual action, except for an Extension of Time application. Therefore, one can consider that all parties responsible for delivering the project are equally liable, or at least have the potential to be equally liable for the delay. Agreements are being reached in which parties agree to absorb their costs and only pursue additional time, as time recovery cannot be mitigated by other means.

Based on the data, which comes with its challenges. Most standard form contracts such as JCT and NEC provide for 'force Majeure events. The delaying party must use their best endeavours to mitigate the effects of the delay. PM describes a 'Gentlemen's agreement' between his organisation, a mechanical and electrical subcontractor, and the main contractor over delays and claims. This terminology suggests that neither party has water-tight contractual protection but has agreed not to pursue the contractual route. An important issue raised by PM, QS1, QS2 and EE was the perceived inability to accelerate. The participants expressed during the interviews that by adhering to Government guidelines on social distancing, accelerating becomes an impossibility. In normal times, a contractor behind the program could often mitigate the issue by simply putting more labour into the project. Therefore, and as evident from the responses, neither their organisations nor their clients have had any other choice but to extend the program to suit. QS1 and QS2 mention the lack of relief available under the contracts they are working on. No recovery of money has been possible for COVID-19 related delays, with



force majeure the only available route. QS2 raises the lack of government clarity being to blame:

“We cannot even cite exercise of statutory power because the government has not expressly told building sites to close.”

QS2’s point is that had they had done so, this would have constituted a relevant matter under JCT Section 4. This would have entitled his company to pursue a loss and expense claim and recover time and money. Force majeure-enabled extensions of time have been awarded on QS2, PL, EE and MS projects. Therefore, their organisations have been expected to mitigate the effects of poor productivity or risk huge project prelim cost increases and costs associated with disrupted labour.

QS2 – “The business has written back my project and all other active projects by about 3% because of COVID-19. So far, looking at my latest ledger costs and what I am now forecasting on labour, it is looking like that was an accurate assessment.”

There is no evidence within the data to suggest that other contractual avenues of recovery have been pursued by the participants’ organisations, employers, or supply chain. QS2, PL and PM all track labour productivity on their projects. PL explains how weekly productivity is tracked as a percentage. With 100% meaning, all program activities have been completed in the time allocated to them by the labour forecast. He explains that his projects usually see an average of 80% productivity per week but have dropped to as low as 20% in some cases, with the drop directly attributable to COVID-19. As highlighted by PM, the consequence of this is an inflated labour and staff cost forecast. PM’s project is due to overspending on labour by 50%. One can conclude from the information presented here that project costs have increased in line with the reduced productivity and with no contractual route to recovery.

### *5.5 Construction communication and productivity*

Virtually all interviewees emphasise how crucial effective communication has been during the crisis. EE’s ‘daily strategy meetings’ are examples of the approach taken on PM’s and PL’s projects. Main contractors and subcontractors are working through issues together with full transparency, supporting Zhong’s theory that quality communication between project teams and clients is the most important factor in ensuring stable and regular progress in difficult times (Zhong and Low, 2009). The government did not shut down construction and did not expressly state how workers should do their business. Aside from trying to keep two metres apart and advising for face coverings to be worn, very little guidance was given to construction workers, which is clear in the data. The participants described a feeling of confusion in the first instance. Organisations have had to fill in the gaps, consequently designing their safe working systems and making decisions between productivity and public health.

The ability to be flexible and adapt to changing situations is an important factor in managing crises. Communication is a key part of this. Vondruska’s (2014) linear communication theory can generally be ascribed to the participants’ organisations. Finding that most organisations cannot be flexible in thinking and communicating, Vondruska (2014) poses that communication breaks down when an unforeseen event occurs. EE comments:

“Nobody knew what they were supposed to be doing at the start. (The company) did not communicate with us. We were already in a national lockdown before hearing anything from the business.”

MS expresses a similar view:

“(communication) was slow initially. We were asking questions and not getting answers. It got better over time, but the first few weeks were a mess.”

Loosemore and Hughes’ (1998) theory of clear communication being absent when needed most in a crisis is observed by these two individuals. It must also be noted that both hold roles directly responsible for site labour productivity. The evidence suggests that this theory applied to both individuals within organisations and the entire UK Government in response to the crisis. The sentiment expressed by the participants was that communication was not only poor at the organisational level but also between departments, between supply chain members, and at the very highest level between the rule-makers in Government and construction companies in general. Loosemore (1999) described a situation where the one thing needed to fix the problem was ironical, the one thing missing. This seems to have been the case here. EE and MS both expressed that they felt unsafe going to work each day partly because they were not being communicated effectively. EE noted that:

“We get our information from the news. No one has told us we cannot go to work, but it does not feel right. It does not take a genius to see that we cannot work to the guidelines.”

“It is even harder to communicate than before. We cannot get hold of people because they are either furloughed or working from home, and their internet is no good.”

These statements were made voluntarily and not in response to any question. His view is shared with the other site-based participants, PM and MS, but was less apparent with those working remotely or from the office. One assumption could be that this emotionally charged view is driven by the fact that he felt his health and the health of his colleagues were being jeopardised, with his management failing to provide them with adequate information.

### *5.6 Management Pitfalls and unavoidable delays*

When it comes to delivering a construction project, the poor productivity of an organisation frequently impacts many other organisations. Particularly if critical path activities are among those being completed unproductively. Often, the consequences of this are severe, resulting in disputes, delays, and late completion. The data support this notion, yielding evidence that reduced site productivity carries far more serious repercussions than the drop in productivity the office staff are experiencing. MS, who leads a team of around ten direct installers and a further six subcontractors, each with a team of operatives, describes a similar situation on their project. Their operatives are being sent elsewhere for the same reason. When questioned on this strategy, MS stated:

“It is a short-sighted business decision. You effectively kick the can down the road and will have the same problem on every project. In my opinion, it is like a domino effect when they would have been better off letting each job fend for itself with labour resources.”

Adding that when an operative is sent to another project, “it increases the chance of exposure and spread of infection, particularly if either the site he has come from or going to, has had cases.”

One can identify similarities between managing the pandemic within the construction industry and Loosemore’s (1998) Three Ironies. When effective communication, mutual sensitivity between project members, and collective responsibility and teamwork are important, they are less likely (Loosemore, 1998). As explored in more detail in Section 5.5, communication efficiency suffered when it was needed more than ever at the start of the pandemic. The existence of mutual sensitivity between management and their employees was not present in the data. The participants often described their feelings of being put at risk by being sent out to work each day. The ability for businesses to continue operating takes precedence over the health of their employees. Loosemore (1998) poses that human nature is to preserve oneself in a crisis (Loosemore, 1998). While not always present initially, collective responsibility and teamwork became the standard way of working as time went on. With employers, main contractors, and subcontractors all seemingly working together. This sentiment was coming from multiple participants. One could conclude that this third irony potentially does not apply to crises where all involved parties are suffering the same effects. All parties are being disrupted, losing staff to infection or self-isolation, and suffering from supply chain delays. Working together, thus ensuring protection from claims, seems to have been the favoured strategy utilised on the interviewees’ projects.

Figure 1 shows the conceptual map using the free edition of the visual paradigm used to connect the six major themes derived quantitatively from Table 2. Figure 1 highlights the connections between the themes as further expatiated in Section 5.7 where the implications of findings were discussed.

**Figure 1** Conceptual map of themes highlighting the influence of construction management practices during the COVID-19 pandemic (see online version for colours)



### *5.7 Implications of findings*

While COVID-19 has had some negative impacts on construction work productivity in the UK, the lessons learned are new forms of effective communication, better organisation, improved payment structures for subcontractors for material delivery and more organisation for the sector (Asis, 2020; Koh, 2020). The government's instructions in a crisis or epidemic situation must consider the response of construction businesses. Stride et al. (2021) affirmed that since the UK construction businesses and their employees must adhere to any instruction given by the government, then the government's clarity on the continuity of business in a crisis must be proactively encouraged. When one considers the chaotic responses of the organisations, reference can be made to Hallgren and Wilson's (2008) crisis management teams. A business that may have previously given such a concept no thought may now see the value in assembling a team dedicated to managing crises, and this, in turn, may need to be factored into initial costs when tendering new work. In a crisis management context, the idea behind risk assessment is that to be forewarned is to be forearmed (Hallgren and Wilson, 2008). Following a crisis, construction organisations should record the lessons learned to ensure a successful response to similar crises in the future (Sahin et al., 2015).

The new ways of working on the construction site have further strengthened the need for health and safety measures (Ogunnusi et al., 2021). Building Information Modelling and other forms of digitalisation in the UK construction sector have proved effective in alleviating the impact of COVID-19 (Jallow et al., 2020). Similarly, remote monitoring of onsite activities through closed-circuit television (CCTV), drones and real-time imaging such as remote sensing must be applied further to ensure increment in productivity. Contractual pitfalls that may result from clauses that do not have epidemics and were forced to use the terms 'force majeure', especially on critical path activities, may apply the relevant matters clause inclusive of payment to contractors due to delays. It is important to note that no construction organisation or project will be immune to the exacerbation of construction risks in moments of crisis. Therefore, construction organisations must develop a post-project review and implementation process for future pandemics. Construction organisations must develop a post-project review and implementation process to learn from previous construction projects' mistakes and positive outcomes in future pandemics. For instance, the construction supply chain productivity can effectively benefit from a 4D BIM integration with the supply chain to bolster the efforts of subcontractors and suppliers (Magill et al., 2020). The use of local and available construction materials, construction technology and labour may also mitigate the effects of delays.

Furthermore, all parties to a construction contract need to work more collaboratively to overcome delays and disruptions, not only in crises but in every construction project. Hence, trust and communication issues in the construction process must be established to strengthen construction productivity and delays and overcome contractual disputes. Change management in construction organisations must be a central focus for the management teams. Crises are moments of difficult change. The construction process is a planned and controlled change. Therefore, managing construction activities in extreme change may benefit construction organisations' computer simulations and proactivity.

## 6 Conclusions and limitations of the study

Hindered by often poor and reactive management decisions and unclear government advice, the PM struggles to maintain overall control of delivering his project during this challenging time. The PM manages reduced productivity, other health and safety procedures, and above all else, uncertainty. Quantity surveyors are experiencing it from a different viewpoint. With overall commercial responsibility for the projects, they face contractual disputes related to performance and delay. They are witnessing cost overruns due to prolonged programs and ever-changing procurement strategies. While their productivity may have been improved thanks to holding meetings remotely and working from home, their workloads have dramatically increased.

This study exposed how human emotion and rational, logical problem-solving can often conflict with construction during crises. The study concludes that human emotion and behaviour exacerbate construction risks in moments of crisis in the construction industry. In preparing for future pandemics, the individual professional responses to COVID-19 must be assessed. In the first instance, one could suggest that PM's organisation fared better than EE's and PL's because they did not panic. The measured taken by each organisation has arguably saved jobs. A recommendation to an organisation experiencing a similar crisis in the future would be to not assume that the short-term solution is to cut costs by reducing unnecessary overheads. PM's firm did not take that action and is now observing relatively stable productivity and good continuity of work.

Conversely, EE's and PL's organisations made much project-critical staff redundant, pre-empting a downturn in production and profits. Several months on, their projects are now suffering a serious labour shortage. They are also finding that supporting business functions that have had their numbers cut are now unable to properly service the projects. PL is a prime example of this.

In terms of the commercial impact of the pandemic and how a business may protect itself, the only viable solution based on the data would be to ensure adequate risk provision is made when tendering new work. The data shows that suffering productivity is an unavoidable consequence of a public health crisis. There is a clear limit to mitigation measures taken onsite to control costs. Making appropriate allowance when pricing work may be the only solution. The result will undoubtedly make the delicate balancing of ensuring that quotes are competitive whilst making a profit even more difficult. Finally, a brief analysis of the interviewees' responses recommended alternative management strategies. The overwhelming consensus among all participants is that the uncertainty of the situation had the biggest impact. Not knowing what was to come, how long it would last, or how bad it would get proved to be why many decisions were taken, both good and bad.

The focus is on the effect that COVID-19 has on the ability of a contractor to resource appropriately to deliver a project onsite. The analysis and comparison of different contractors are outside the scope of this research and is recommended area for further research. This study focused on a small sample of general building contractors, mechanical and electrical services contractors, and major house-building contractors in the construction industry, as indicated in the materials and methods section. Further research would be an inquiry into the idea that management teams and the government would allow guidelines to be broken and workers' health jeopardised to meet deadlines. There is evidence within the interview data to justify the need for further investigation.

The small sample utilised in this study cannot demonstrate such a controversial subject as being anything more than the opinion of one or two individuals. Again, a quantitative study of a larger scale and a larger sample would be appropriate to measure whether this school of thought is present throughout the industry or restricted to isolated incidences.

## References

- Alenezi, T.A.N. (2020) 'COVID-19 causes of delays on construction projects in Kuwait', *International Journal of Engineering Research and General Science*, Vol. 8, No. 1, pp.6–9.
- Araya, F. (2020) 'Modelling the spread of COVID-19 on construction workers: an agent-based approach', *Safety Science*, Vol. 133, No. 105022, pp.1–7.
- Asis, C.A.D. (2020) 'The lived experiences of construction workers during COVID-19 pandemic: In Suburban case', *South Asian Journal of Social Studies and Economics*, Vol. 8, No. 4, pp.98–103, DOI: 10.9734/sajsse/2020/v8i430222.
- Bailey, J. (2020) *COVID-19: The Current Impact on Construction and Engineering Projects* [online] <https://www.whitecase.com/publications/alert/covid-19-current-impact-construction-engineering-projects>.(accessed 08 November 2020).
- Biswas, A., Ghosh, A., Kar, A., Mondal, T., Ghosh, B. and Bardhan, P.K. (2021) 'The impact of COVID-19 in the construction sector and its remedial measures', in *Journal of Physics: Conference Series*, IOP Publishing, p.12054.
- Boamah, F.A., Zhang, J., Shehzad, M.U.S. and Wen, D. (2022) 'Exploring the impact of social capitals and knowledge creation on construction firms performance in the COVID-19 era', *Journal of Engineering, Design and Technology*, ahead-of-print [online] <https://doi.org/10.1108/JEDT-10-2021-0569>.
- Casady, C.B. and Baxter, D. (2020) 'Pandemics, public-private partnerships (PPPs), and force majeure | COVID-19 expectations and implications', *Construction Management and Economics*, Vol. 38, No. 12, pp.1077–1085, DOI: 10.1080/01446193.2020.1817516.
- Charmaz, K. (2014) *Constructing Grounded Theory*, Sage, London.
- Chih, Y-Y. et al. (2022) 'Resilience of organizations in the construction industry in the face of covid-19 disturbances: dynamic capabilities perspective', *Journal of Management in Engineering*, American Society of Civil Engineers, Vol. 38, No. 2, p.4022002.
- Creswell, J.W. (2014) *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*, 4th ed., Sage Publications Ltd., London.
- Dainty, A., Moore, D. and Murray, M. (2007) *Communication in Construction: Theory and practice*, Routledge, London.
- Goodman, J. (2020) *Coronavirus Impacts Could Have a Ripple Effect on the US Construction Industry* [online] <https://www.constructiondive.com/news/coronavirus-impacts-could-have-ripple-effect-on-us-construction-industry/572586/>. (accessed 8 November 2020).
- Goodman, S. (2020) 'SARS Stung the global economy', *The Coronavirus Is a Greater Menace* [online] <https://www.nytimes.com/2020/02/03/business/economy/SARS-coronavirus-economic-impact-china.html>. (accessed 31 October 2020).
- Gunning, J.G. and Hanna, J.I.C. (2001). The application of risk management principles to crisis management in construction. At 17th Annual ARCOM Conference.
- Hallgren, M. and Wilson, T.L. (2008) 'The nature and management of crises in construction projects: Projects-as-practice observations', *International Journal of Project Management*, Vol. 26, No. 8, pp.830–838.
- Iheukwumere, O., Moore, D. and Omotayo, T. (2021) 'Analysis of multi-factors affecting the performance of Nigeria's refineries: a systems thinking approach', *International Journal of Productivity and Performance Management*, Emerald Publishing Limited, DOI: 10.1108/IJPPM-11-2020-0585.

- Jallow, H., Renukappa, S. and Suresh, S. (2020) 'The impact of COVID-19 outbreak on United Kingdom infrastructure sector', *Smart and Sustainable Built Environment*, Vol. 10, No. 4, pp.581–593, Emerald Publishing Limited [online] <https://doi.org/10.1108/SASBE-05-2020-0068>.
- Kaklauskas, A., Kelpsiene, L., Zavadskas, E.K., Bardauskiene, D., Kaklauskas, G., Urbonas, M. and Sorakas, V. (2011) *Crisis Management in Construction and Real Estate: Conceptual modelling at the micro-, Meso-and Macro-Levels. Land Use Policy*.
- Koh, D. (2020) 'Occupational risks for COVID-19 infection', *Occupational Medicine*, Vol. 70, No. 1, pp.3–5, DOI: 10.1093/occmed/kqaa036.
- Lagadec, P. (1997) 'Learning processes for crisis management in complex organisations', *Journal of Contingencies and Crisis Management*, Vol. 5, No. 1, pp.24–31.
- Lawson, A. (2020) *Every UK Recession to Have Taken Place in Modern History: From the Three-Day Week to the 2008 Crash and the Coronavirus Crisis* [online] <https://www.standard.co.uk/business/uk-economy-historic-recessions-a4520961.html> (accessed 31 October 2020).
- Lerbinger, O. (1997) 'The crisis manager: facing risk and responsibility (book review)', *Journalism and Mass Communication Quarterly*, Vol. 74m No. 3, p.646.
- Loosemore, M. (1998) 'The three ironies of crisis management in construction projects', *International Journal of Project Management*, Vol. 16, No. 3, pp.139–144.
- Loosemore, M. (1999) 'A grounded theory of construction crisis management', *Construction Management and Economics*, Vol. 17, No. 1, pp.9–19.
- Loosemore, M. and Hughes, W. (1998) 'Reactive crisis management in constructive projects – patterns of communication and behaviour', *Journal of Contingencies and Crisis Management*, Vol. 6, No. 1, pp.23–34
- Magill, L.J., Jafarifar, N., Watson, A. and Omotayo, T. (2020) '4D BIM integrated construction supply chain logistics to optimise on-site production', *International Journal of Construction Management*, pp.1–10, Taylor & Francis, DOI: 10.1080/15623599.2020.1786623.
- Ogunnusi, M., Omotayo, T., Hamma-Adama, M., Awuzie, B.O. and Egbelakin, T. (2021) 'Lessons learned from the impact of COVID-19 on the global construction industry', *Journal of Engineering, Design and Technology*, Emerald Publishing Limited, DOI: 10.1108/JEDT- 05-2021-0286.
- Omotayo, T., Awuzie, B., Obi, V., Ajayi, S, Obi, L., Osobajo, O. and Oke, A. (2022) 'The system dynamics analysis of cost overrun causations in UK rail projects in a COVID-19 epidemic era', *Sage Open*, Vol. 12, No. 2, pp.1–22, <https://doi.org/10.1177/21582440221097923>.
- Omotayo, T., Olanipekun, A., Obi, L. and Boateng, P. (2020) 'A systems thinking approach for incremental reduction of non-physical waste', *Built Environment Project and Asset Management*, DOI: 10.1108/BEPAM-10-2019-0100.
- Omotayo, T.S. Boateng, P., Osobajo, O., Oke, A. and Obi, L.I. (2019) 'Systems thinking and CMM for continuous improvement in the construction industry', *International Journal of Productivity and Performance Management*, Vol. 69, No. 2, pp.271–296, DOI: 10.1108/IJPPM-11-2018-0417.
- Reid, J.L. (2000) *Crisis Management: Planning and Media Relations for the Design and Construction Industry*, John Wiley & Sons, London.
- Sahin, S., Ulubeyli, S. and Kazaza, A. (2015) 'Innovative crisis management in construction: approaches and the process', *Procedia – Social and Behavioural Sciences*, Vol. 195, No. 2015, pp.2298–2305.
- Shashank, K., Hazra, S. and Pal, K.N. (2014) 'Analysis of key factors affecting the variation of labour productivity in construction projects', *International Journal of Engineering Technology and Advanced Engineering*, Vol. 4, No. 5, pp.152–160.

- Srinivasan, N.P. and Nandhini, N. (2015) 'A Study on crisis management in construction projects', *International Journal of Innovative Research in Science, Engineering and Technology*, Vol. 4, No. 10, pp.9965–9967.
- Stiles, S., Golightly, D. and Ryan, B. (2021) 'Impact of COVID-19 on health and safety in the construction sector', *Hum. Factors Man.*, Vol. 31, pp.425–437 [online] <https://doi.org/10.1002/hfm.20882>.
- Stride, M., Renukappa, S., Suresh, S. and Egbu, C. (2021) 'The effects of COVID-19 pandemic on the UK construction industry and the process of future-proofing business', *Construction Innovation*, ahead-of-print [online] <https://doi.org/10.1108/CI-03-2021-0045>.
- Suresh, S., Renukappa, S. and Stride, M. (2020) *The Impact of COVID-19 on the UK Construction Industry*, Business, Energy and Industrial Strategy Committee, UK Parliament [online] <http://hdl.handle.net/2436/623423>.
- Umar, T. (2022) 'The impact of COVID-19 on the GCC construction industry', *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET)*, IGI Global, Vol. 13, No. 2, pp.1–17 [online] <https://www.standard.co.uk/business/uk-economy-historic-recessions-a4520961.html>. (accessed 1 November 2020).
- Vondruska, M. (2014) 'Early warning system for detection of the crisis in construction projects', in *Proceedings of Creative Construction Conference 2014*, Prague, Czech Republic, 21 June, pp.383–388.
- Weller, S.C. et al. (2018) 'Open-ended interview questions and saturation', *PLOS ONE*, Vol. 13, No. 6, pp.1–18, Public Library of Science, DOI: 10.1371/journal.pone.0198606.
- Zhang, Y. and Wildemuth, B.M. (2009) 'Qualitative analysis of content', *Applications of Social Research Methods to Questions in Information and Library Science*, Vol. 4, No. 10, pp.9965–9967.
- Zhong, Y. and Low, S.P. (2009) 'Managing crisis response communication in construction projects – from a complexity perspective', *Disaster Prevention and Management: An International Journal*, Vol. 18, No. 3, pp.270–282.

## Appendix

*Thematic analysis is taken from the responses to each question*

- 
- |   |   |
|---|---|
| 1 | How has COVID-19 affected your productivity over the last 12 months?            |
| a | Additional workload (PM, MS)  |
| b | More processes to follow (PM)   |
| c | Increased health and safety obligations (PM)                                    |
| d | Fewer distractions due to fewer staff in the office (QS2, PL)                   |
| e | Communication difficulties (QS2, EE)  |
| f | Sharing important project information is more difficult (QS2, EE)               |
| g | Not affected negatively (QS1)   |
| h | Working from home – more time to be productive due to less travelling (QS1, PL) |
| i | Working more efficiently as not required to have face-to-face meetings (QS1)    |
| j | Concerns over personal safety – reluctance to be onsite (EE)                    |
| k | Lack of support due to redundancies and furlough (MS)                           |
-



*Thematic analysis is taken from the responses to each question (continued)*

- 
- 2 What has been the biggest change to your everyday duties due to COVID-19?
- a Less face-to-face interaction (PM, EE)
  - b Reduced capability in finding quick solutions to problems (PM)
  - c Everything takes longer (PM, EE)
  - d Reduced working week but no reduction in workload (QS2)
  - e No major changes due to being office-based (QS1)
  - f Site-based operatives are affected far more than office-based operatives (QS1)
  - g Government turning a blind eye to construction site operations (QS1)
  - h Working with a smaller team (EE)
  - i Having to overcome challenges in communicating with multiple parties (EE)
  - j Increased workload due to redundancies/furlough (MS, PL)
- 3 What approach has your organisation taken in managing productivity during the pandemic?
- a Followed government guidelines (QS1, QS2, EE, MS, PL)
  - b Avoided unnecessary COVID-19 processes if they were detrimental to productivity (PM)
  - c Processes implemented quickly (MS)
  - d Went above and beyond with keeping staff safe (PM, QS1)
  - e Lack of protection for site-based workers (EE)
  - f Business as usual approach as there is no clear guidance for the construction industry (PL)
- 4 What measures has your department/project management team introduced to manage reduced productivity?
- a Working from home where possible (QS1, QS2, EE, MS, PL)
  - b Social distancing (QS1, QS2, EE, MS)
  - c Office layout change (QS1, QS2, EE, PL)
  - d Provided laptops so staff can work productively from home where possible (PM)
  - e Regular health and safety inspections on site (PM)
- 4 What measures has your department/project management team introduced to manage reduced productivity?
- f Temperature checks upon entry to office and construction sites (QS1)
  - g Full-time cleaner employed (QS1)
  - h Reduced capacity in meeting rooms (QS1)
  - i Very few measures were introduced onsite as the government's guidelines on the construction industry are vague (EE)
  - j Staff furlough (PL)
-

*Thematic analysis is taken from the responses to each question (continued)*

- 
- 5 Have you noticed a change in approach to managing productivity from the first lockdown of March 2020 to now?
- a No change from the first lockdown to now (QS2, PL)
  - b Better prepared now compared to the first lockdown (PM, QS1, EE, MS)
  - c Able to work more productively with experience (PM, QS1, MS)
  - d Chaotic at first but more efficient now (QS1)
  - e The first lockdown had a big impact on productivity, less so now (EE, MS)
  - f Conditions on site are still not safe (EE)
  - g Less use of furlough scheme now as the organisation is now better at managing productivity (MS)
  - h Processes have become more streamlined (PL)
- 6 Overall, how would you rate your organisation's labour productivity management during the pandemic?
- a Unsure exactly as other factors have been contributing to poor productivity (QS2)
  - b They have done what is necessary and implemented processes quickly (QS1)
  - c Handled well and remained stable – avoided redundancies (PM)
  - d Business as usual onsite – feel as though unnecessary risks are being taken (EE, PL)
  - e They have handled productivity poorly by constantly moving operatives between sites (EE, PL)
  - f Has not changed. Operatives are still expected to work at the same level of efficiency as before (MS)
- 7 Have any new procedures and operational changes forced upon your organisation due to the pandemic improved productivity to the extent that they are likely to remain after the pandemic is over?
- a Video conferencing, i.e., Microsoft Teams, to avoid the need for unnecessary travel (PM, QS1, QS2, EE, MS, PL)
  - b Working from home for people who can, i.e., support staff (PM, QS1, PL)
  - c Keeping operatives from gathering has improved productivity in some cases (PM)
  - d No COVID-19 related procedures onsite will be kept as they are only harmful to productivity (PL)
- 8 Are projects you are involved in currently experiencing disruption due to the pandemic?
- a Not currently – aware of other organisations facing these problems (PM)
  - b Delayed starts to projects (QS1)
  - c All new-build housing sites closed for two weeks (QS1)
  - d Minimal – project in final stages of the build and not at risk of major disruption (QS2)
  - e All projects experiencing delay and disruption (PL)
  - f Disruption is happening, and program activities are taking longer than expected (EE, MS)
-

*Thematic analysis is taken from the responses to each question (continued)*

- 
- 9 If you are working on a live project, has the program duration or scope of work changed to accommodate COVID-19 related delays?
- a Acceleration required to mitigate reduced labour levels and productivity (PM)
  - b Expecting to complete the project on time (PM)
  - c No – the contract program is being achieved due to the project nearing completion at the time of the first lockdown (QS2)
  - d Program prolongation is occurring on most projects (QS1)
  - e Some projects have been shelved temporarily (QS1)
  - f EOT awarded by client citing force majeure (EE, MS, PL)
  - g Program delays due to having to socially distance (MS)
  - h Program delays and impacted progress due to operatives self-isolating (MS)
  - i Re-sequencing of program activities due to delays in materials deliveries (MS)
  - j Organisations are taking advantage of the pandemic to get ‘free’ EOTs (PL)
- 10 How has supply chain productivity suffered because of labour and materials shortages?
- a Self-isolation/positive cases have impacted subcontract labour resources (QS1, QS2, MS, PL)
  - b Delays in materials coming from overseas (PM, EE, MS)
  - c Better planning and early procurement of materials and services is necessary to avoid delays (PM, EE)
  - d Reduced labour numbers and have impacted subcontract labour productivity staff absence (QS2, PL)
  - e Timber shortages have forced spec changes (QS1)
  - f Some self-employed contractors are de-motivated and taking advantage of Government grants (QS1)
  - g Longer than usual lead times on materials (MS)
  - h Productivity has been affected by having no continuity of labour (PL)
- 11 What kind of disputes (if any) are you currently having with the employer/main contractor because of COVID-19 related supply chain failures?
- a Early warning notices issued to supply chain (PM)
  - b Loss and expense claim issued for poor productivity due to COVID-19 related disruption (QS2)
  - c As a developer, all liability is with us (QS1)
  - d All parties experiencing disruption and culpable for the delay, so working together without pursuing claims is the best option for everybody (PM, EE, PL)
  - e Lack of materials onsite has caused friction with the main contractor (MS)
  - f Acceleration and prolongation are frequent issues (PL)
-

*Thematic analysis is taken from the responses to each question (continued)*

- 
- 12 What has been the single biggest impact of COVID-19 on the construction industry?
- a Unable to effectively accelerate due to adhering to government guidelines, i.e., social distancing (PM)
  - b Clients not proceeding with planned projects (QS2, PL)
  - c Clients/employers not agreeing on costs due to uncertainty over their financial stability (QS2)
  - d The initial impact and first lockdown – lots of unknowns (QS1)
  - e Workers continually putting their health at risk (EE)
  - f The furlough scheme has had a huge impact on productivity (EE)
  - g Delayed supply of materials and materials shortages impacting critical path activities (MS)
  - h Program delays (PL)
-