Impact of COVID-19 on project performance in the UAE construction industry

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Abstract

Purpose – The coronavirus disease 2019 (COVID-19) pandemic has affected the global economy and, thus, the global construction industry. This paper aims to study the impact of COVID-19 on construction project performance in the United Arab Emirates (UAE).

Design/methodology/approach – This study adopted a qualitative and exploratory approach to investigate the impact of COVID-19 and its policies on project performance in the UAE construction industry in critical areas of the project management body of knowledge (e.g. schedule, cost, resources and contracts). Semi-structured interview questions were asked from ten construction professional to obtain valuable insights into the pandemic's effects on the UAE construction industry and the effectiveness of policies implemented to rectify the damage and identify the industry's new normal.

Findings – The findings indicate that the construction industry faced several challenges such as schedule delays, disrupted cashflows, delayed permits, approvals and inspections, travel restrictions, serious health and safety concerns, material and equipment shortages, among others which hindered the timely delivery of construction projects. It also indicates that efforts made by the government institutions and the construction industry of the UAE such as economic support programs, digitization of processes, fee and fine waivers, health facilities, among other statutory relaxations proved effective in supporting the construction industry against the adverse effects of the pandemic.

Research limitations/implications – The research findings are limited to the literature review and ten semi-structured interviews seeking an expert's opinion from industry professionals working in the UAE construction industry. The research team did not get access to project documents, contracts and project progress reports which may be required to validate the interview findings, and to perform an in-depth analysis quantifying the impact of COVID 19 on construction projects performance, which is a limitation of this research.

Practical implications – The implication is that, owing to the imposed lockdowns and strict precautionary measures to curb the rapid spread of the pandemic, smooth execution of the construction project across the country was affected. The government institutions and stakeholders of the construction projects introduced and implemented various techniques and solutions which effectively handled the implications of the COVID-19 pandemic on the construction industry of the UAE.

Originality/value – This study has identified the challenges faced by the construction industry of the UAE in the context of the management of project schedule, project cost, construction contracts, health and safety of construction employees and other related aspects of the construction projects. This study also identified the techniques and solutions adopted by various public and private institutions of the country and their implications on construction projects. Therefore, this study provides guidelines for policymakers and future research studies alike.

Keywords Construction project management, Built environment research, Construction management

Paper type Research paper

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Introduction

The infrastructure sector is an integral part of every country's economy (Weber and Alfen, 2016) because it contributes to the economy and citizens' overall well-being. Approximately US$10tn is spent globally on construction-related goods and services every year (McKinsey Global Institute, 2020). As per Statista (2020), construction expenditures are projected to reach US$14tn in 2025. Construction contributes to a country's overall gross domestic product (GDP) and engages a large number of people at different hierarchical levels, who contribute in their respective capacities to execute projects.

Coronavirus disease 2019 (COVID-19), declared a global pandemic by the World Health Organization (WHO), has caused economies in the Middle East to suffer significantly because of the measures implemented to control its spread. Statistics provided by the International Air Transport Association (IATA, 2020) show that 1.7 million jobs in the Middle East will be lost as a result of border closures reinforced because of COVID-19. Every economy is introducing practices such as social distancing and has aggressively embraced work-from-home or remote working practices instead of working in offices (Baveja *et al.*, 2020). World leaders are collaborating to introduce and implement measures that garner positive results and ensure a safe environment and the well-being of their citizens to enable economies to gradually revive (Yam *et al.*, 2020). Similarly, the United Arab Emirates (UAE) has taken precautionary measures to reinforce the safety of its residents and measures that directly affect the performance of ongoing construction projects (Ghandour, 2020).

Legislations and precautionary measures introduced by authorities have impacted the smooth execution of construction projects (Khalfan and Ismail, 2021). Although some preliminary studies are available which discussed the context of COVID-19 and construction, very few discussed the in-depth implications of the pandemic on construction, are region-specific and do not give insight into the condition of the UAE construction industry (Alsharef *et al.*, 2021; Jallow, 2020). This study addresses the impacts of the pandemic on construction project performance in the UAE and evaluates how well the country's construction industry has endured the ongoing pandemic. The specific aims of this research study are as follows:

- to assess the impact of the disruptions caused by the COVID-19 pandemic on the overall performance of construction projects in the UAE;
- to identify the measures announced by local authorities, whether precautionary, preventive or economic support and their respective impact on the UAE construction industry; and
- to present the corrective measures, methods and techniques adopted by the construction industry to address the pandemic situation and their effectiveness.

Literature review

Significance of the United Arab Emirates construction industry

The UAE construction industry is considered among the most established industries in the world. It attained this stature gradually. In the 1960s, oil was first discovered in the UAE, kick-starting the construction industry toward fulfilling the region's infrastructural needs. The UAE eventually transformed itself into a dynamic country based on zealous tourism and business activities that became its push factor in involving itself in grandiose construction projects and attracting international construction stakeholders to participate in them (El-Sayegh *et al.*, 2020). The construction sector plays an important role in the UAE's economy (Johnson and Babu, 2018; Zahmak *et al.*, 2020; Enshassi *et al.*, 2016; Abdullahi *et al.*, 2018; Muhammad, 2017), which

is why it attracts investments and strong government support. The pragmatic policies adopted by the UAE government include allocating oil revenue to the developing non-oil economy to attract foreign investments and financing infrastructure, development and housing projects (Al-Malkawi and Pillai, 2013).

As per El-Sayegh *et al.* (2020), the UAE construction industry has consistently grown and is expected to further achieve greater milestones in infrastructure construction. The gradual increase in the UAE's GDP over the years indicates the importance given to local construction. The contribution of construction to the GDP is projected to increase from 10.3% in 2011 to 11.5% in 2021 (Dubai Chamber of Commerce Study, 2012). As per Zahmak *et al.* (2020) and Al-Ameri *et al.* (2020), investments of approximately AED3tn were made in construction in 2017, which accounted for 33% of the total value of all construction projects that materialized in Gulf Corporation Council (GCC) countries. The construction industry is transforming the UAE into a digitally advanced region, as pledged in its 2025 Vision (Al-Ameri *et al.*, 2020). The industry involves approximately 2 million people representing approximately 7.2% of the total workforce, thus establishing a stable economy (Daleure, 2017).

Generally, UAE construction projects are challenged with strict deadlines and capital expenditure caps because of private sector developers' commercial and marketing policies. As per Shafiq and Afzal (2020), different infrastructure projects costing more than US$55bn are underway in the UAE, including the construction of metro lines, Expo 2020 and airport extensions, among others. Dubai, one of the UAE's emirates, is famous for having the highest per square kilometer of construction activity globally (Faridi and El-Sayegh, 2006). Similarly, the world's first-of-a-kind infrastructure projects were constructed in the UAE, including the Burj Khalifa, the world's tallest building, which was completed in 2010 (BBC, 2010). Although this industry plays an important role in the UAE's economy, it faces serious issues that impede its progress, such as lack of project financing, less time and cost overruns (Zahmak *et al.*, 2020). These challenges affect not only the construction industry but also the country's overall economy. For example, the global financial crisis, which halted the world's economies in 2007, slowed down the architecture, engineering and construction (AEC) industries but, overall, did not impede the UAE's commitment to development and infrastructure (Mehran, 2016). The 2011 Al-Masah Capital Limited report noted that the UAE construction industry contributed 60% of the property boom in the GCC, with Dubai contributing 47% of the GCC total (Mehran, 2016). The UAE's infrastructure industry is expected to tackle the current economic barriers with the same ability, considering this trend and the current global economic situation resulting from the pandemic.

COVID-19 and its implications on construction industry

Construction projects have become more difficult and complex owing to the presence of many critical success factors (Chan *et al.*, 2004). The advent of the COVID-19 pandemic has affected the performance of several success factors including planning, execution, communication, economic, social, political and technological factors (Denny-smith *et al.*, 2021; Khalfan and Ismail, 2021; Stiles *et al.*, 2021). Most critical among all factors is the health and safety of the front-line construction workers. Stiles *et al.* (2021) investigated the guidelines provided by various national and international health authorities and their implementation and effectiveness in the construction industry. Wang (2021) explored the urban and architectural design perspective of urban developments and their potential to reduce the spread and impact of such pandemics in the future. Casady and Baxter (2020) researched the existing framework of public-private partnerships (PPP) and emphasized the need for reevaluating the Force Majeure clause from a PPP perspective. Moreover,

Khalfan and Ismail (2021) stated the Kingdom of Bahrain's COVID-19 action plan, its implications on the construction sector. However, these studies lack in-depth analysis and insight into the implications of COVID-19 on the construction industry.

The successful execution of construction projects still hinders by the implications of COVID-19. Several studies are being undertaken to understand the impact of the pandemic on execution aspects of the construction projects world over. Jallow (2020) conducted a study to gauge the impact of COVID-19 on the infrastructure sector of the UK and found that this pandemic forced most of the staff and workers to stay at their homes and work remotely, hence, making the project management extremely difficult which lead to delays. Alsharef *et al.* (2021) identified the adverse effects of COVID-19 pandemic on the USA's construction industry and identified material delivery and permitting delays, material and workforce shortages, lower worker and equipment productivity, cash flow disruptions and financial losses and potential conflicts and disputes. Similarly, Amoah and Simpeh (2020) researched the implementation challenges of health and safety measures to curb the adverse effects of COVID-19 and identified the hardships faced by South Africa's construction industry. It is clear from the studies that the construction industry around the globe faced adverse effects owing to COVID-19 pandemic, which prevented the successful execution of construction projects.

The COVID-19 pandemic also hit the UAE hard and resulted in the closure of all construction-related activities, including the much-awaited Expo 2020 in Dubai (Baycar, 2020). Similarly, the construction sector was affected by the "lockdowns," which were implemented to "flatten the curve" (Caulkins *et al.*, 2020). Because the construction industry is the backbone of the UAE's economy, measuring the effects of this pandemic on the overall performance of construction projects is of utmost importance (Mashreq, 2020). Ghandour (2020) aimed at establishing the implications of COVID-19 on project delivery from the perspective of the construction industry of the UAE. Results suggested that there is a significant increase in the required days to complete the project owing to the inaccessibility to raw material and labor. However, studies investigating the impact of COVID-19 on the performance of various project aspects (such as schedule and contract performance) and identifying measures taken to address the prevailing situation, especially within the context of the UAE, are lacking.

This study is the starting point of the exploration of the impact of COVID-19 on the UAE construction industry and investigates the degree to which construction projects are affected in terms of their schedules, costs, resources and contracts. This research also lays out the current conditions in the UAE construction industry and how well it has managed situations during the pandemic. Further, this study highlights the recommendations provided by industry experts who suggested using the pandemic as an opportunity to make construction stakeholders and policymakers realize the importance of adopting digital mechanisms in business continuity.

Research methodology

This study is exploratory in nature and uses semi-structured interviews. A semi-structured interview is a data collection method that is well suited for exploring participants' opinions regarding complex information and probing further explanations to answers (Barriball and While, 1994). This qualitative inquiry approach is best suited for this research for the following reasons:

- to quickly identify the challenges faced by construction professionals during the COVID-19 pandemic through first-hand interactions;

- to allow experts to speak in greater detail on issues that the researcher raises and to introduce new issues related to the subject matter;
- to present business continuity strategies that address the challenges presented by the COVID-19 situation; and
- to allow the researcher to change the questions if participants raise issues to which the questions do not cater.

The semi-structured interviews were conducted following the guidelines laid out by Rabionet (2011). Different aspects of construction projects were considered during these interviews to evaluate the impact of the pandemic on key aspects and situation-specific factors. The research objectives were translated into the following six major categories:

(1) project schedule;
(2) project cost;
(3) project resources;
(4) contracts
(5) working with COVID-19-specific standard operating procedures (SOPs); and
(6) normalization, pandemic-proof policies and future directions.

Consequently, this research was underpinned by the following categories:

- Category 1 Questions – Project Schedule. To understand the impact of COVID-19 on the schedule performance of ongoing and planned projects;
- Category 2 Questions – Project Cost. To understand how the pandemic disrupted the financial planning for ongoing and planned projects;
- Category 3 Questions – Project Resources. To understand how stringent lockdowns, restricted travel and other key measures imposed to curtail the spread affected the availability of vital resources for ongoing projects;
- Category 4 Questions – Contracts. To understand the efficiency and performance of current contracts in handling the COVID-19 pandemic;
- Category 5 Questions – Working with SOPs. To understand project performance under the implementation of novel SOPs announced by the authorities; and
- Category 6 Questions – Normalization, pandemic-proof policies, and future directions. To estimate the normalization of the current situation and how the construction industry plans to address similar future situations.

Sampling size and nature of semi-structured interviews

Sampling assists with representing a large population by obtaining responsible responses that are otherwise difficult to obtain because of different restrictions (Saunders *et al.*, 2019). A purposive sampling technique is used in this study (Teddlie and Tashakkori, 2010) for the following reasons:

- willingness to participate;
- ease in accessibility; and
- experience in the construction industry.

A similar technique was used by Jallow (2020) to evaluate the effect of the COVID-19 outbreak on the construction industry in the UK, by conducting five semi-structured interviews.

Different industry professionals holding key positions and with years of experience in their respective fields were interviewed. Participants were selected based on their backgrounds and years of experience. The most suitable participants were shortlisted after a careful evaluation of their profiles and the type of data required to achieve the objectives of this study. The interviews were designed to obtain feedback on each phase of the construction, and the study sample included members from senior management, design teams, coordination teams, planning and control teams and on-site execution staff. More semi-structured questions were asked to obtain an in-depth response from each participant, depending on his or her background. For example, a participant with a background in contracts was expected to provide a more thorough answer about contracts; thus, various semi-structured questions were asked to gather more detailed knowledge of the effects of the COVID-19 pandemic on current contractual bindings and how the company managed the situation. These categories were structured in a sequence, allowing participants to always correlate to the previous category and more accurately summarize and articulate their rationale in a coherent manner. Table 1 displays information on participants' backgrounds, expertise and traits of the company with which they are associated.

Shortlisted participants were contacted, and interview dates were scheduled using the Doodle app. To avoid face-to-face interactions and adhere to the social distancing measures introduced by the authorities in the UAE, interviews were conducted using the online meeting platforms Zoom and Microsoft Teams. Initially, a transcript was read that asked for the participants' consent to anonymously use their feedback for this research. The interviews were recorded, and their durations were approximately 30 min. Written transcripts of the discussions were generated from the recorded sessions. To analyze the results of this study thematic analysis was conducted and themes were categorized based on a deductive approach based on existing knowledge and prevailing pandemic conditions, which resulted in the Findings and Discussion section.

Table 1
Demographic profile of participants

Sr. no.	Current position	Participant code	Years of experience	Type of organization	Size of organization
1	Director of Quality and a PMO Member	P1	22	Client	1,200+
2	Director of Construction Management	P2	21	Contractor	5,000+
3	Senior Design Engineer	P3	16	Design Agency	1,000+
4	BIM Manager and Chief Specialist	P4	15	Government Agency	1,000+
5	Senior Design Engineer	P5	15	Consultant	2,000+
6	Senior Contracts Engineer	P6	12	Contractor	1,000+
7	Assistant BIM Manager	P7	10	Client	250+
8	Project Engineer	P8	8	Contractor	1,500+
9	Site Engineer	P9	7	Contractor	5,000+
10	Planning Engineer	P10	6	Contractor	1,200+

Interview specifics

Each category is briefly discussed as follows and provided in Figure 1.

Project schedule. This category comprised three questions on the impacts of COVID-19-related policies on construction schedules. The questions also attempted to collect information on how the construction industry responded to these impacts and to what extent ongoing construction projects were delayed. These questions also attempted to identify the measures and strategies adopted to minimize the effect of these impacts. Furthermore, planning strategies for future projects or early execution phases were investigated.

Project cost. This category also comprised three questions aimed at ascertaining the true extent to which project cash flows were affected by the pandemic and related policies. This category aimed to determine the disruption in clients' progress payments to contractors, sub-contractors, material suppliers and vendors. Almost every business around the globe opted for cost-cutting or cost optimization during the pandemic. This study also attempted to investigate the impact on employee salaries. Also discussed were the policies of banks and other lending agencies and how they affected the UAE construction industry.

Project resources. This category focused on the availability of key resources, such as manpower, materials and equipment, during the pandemic and its effect on project performance. It also focused on alternate solutions adopted to keep projects on track and how different stakeholders worked out strategies to manage this unique situation. Finally, this category addressed how projects were being managed during the pandemic without the required resources.

Contracts. The most important aspect of managing the pandemic was the "contract." This category investigated how current contract clauses were handled during the pandemic and gauged the effectiveness of current contracts with respect to the pandemic. This category attempted to identify the changes made to existing contracts related to project deadlines, extensions, cost compensations, specification modifications and liquidated damages. Furthermore, it investigated the "force majeure" clause in contracts and its effectiveness in addressing issues that arose because of the COVID-19 pandemic. Finally,

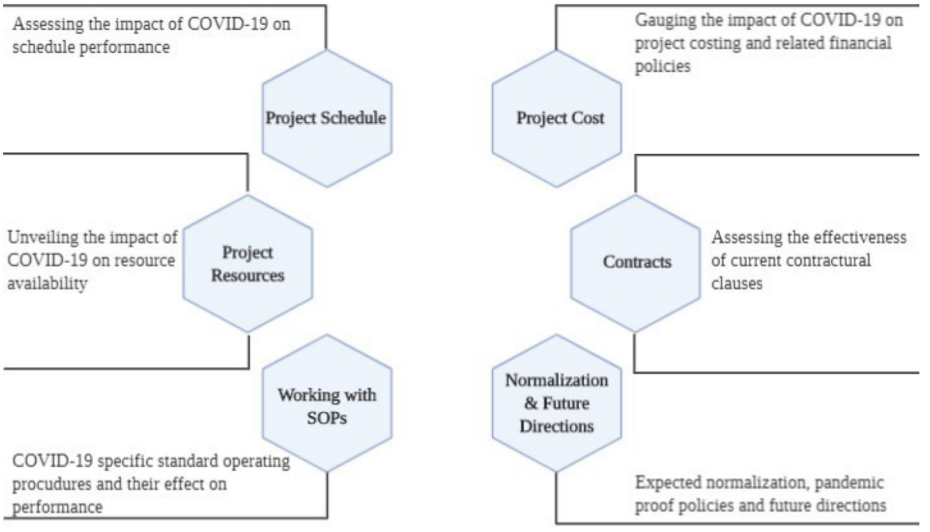

Figure 1
Selected categories for investigating COVID-19 impacts

this category inquired about contractual modifications suggested by international contract institutes, such as the International Federation of Consulting Engineers (FIDIC), or changes in local laws by the UAE government.

Working with standard operating procedures. This category of questions examined the effects of precautionary measures and novel SOPs introduced by the authorities to curb the spread of COVID-19. It also focused on identifying how working with SOPs was different and their influence on project performance. This category also attempted to identify the set of SOPs announced for the UAE construction industry and whether the construction industry required new safety training and equipment to ensure the effective implementation of the SOPs. It also investigated how social distancing was ensured and the extent to which construction workers followed precautionary measures. Finally, this section inquired about the procedures for addressing individuals with COVID-19 symptoms and ensuring the well-being of all workers on a site.

Normalization, future directions and pandemic-proof policies. This category inquired about the construction industry's expectations of the potential normalization of the current situation and its view about the new normal for future construction projects. It also investigated the industry's preparedness for planned construction projects and the most anticipated second wave of the COVID-19 pandemic. Finally, this category investigated how the lesson learned from this pandemic could be used to better prepare for such situations in the future.

Findings and discussion

Project schedule

Summary of results. All respondents agreed that the COVID-19 pandemic and the policies announced by the authorities to curb its spread affected the overall performance of construction project schedules. Initially, the rapid spread of the virus halted operations at all construction sites across the country. Soon after, the authorities permitted the construction industry to remain operational, and workers were allowed to travel to and from the worksite after obtaining special permits. This disruption delayed projects and completion dates were renegotiated to accommodate the impacts of the pandemic. Since that time, various techniques were adopted to put the projects back on track by using all available resources. As a result, the relaxation announced by the authorities for the construction industry and the positive attitude of all stakeholders toward resolving the current situation helped the overall industry toward normalization.

Q1. How do COVID-19 and its related policies impact the performance of the project schedule?

All participants indicated that the efficient performance of the construction project schedule depends on many factors, such as the workforce, materials, equipment availability and a suitable work environment. As COVID-19 began spreading in the UAE, the concerned authorities implemented a strict lockdown to stop the spread of the deadly virus, resulting in international border closures, air travel bans, inter-emirate travel bans and industry shutdowns. These conditions forced an operational disruption across the construction supply chain. Most of the materials used in construction projects in the UAE are imported from other countries. However, the pandemic disrupted economies all around the globe, which adversely affected the execution of the projects. Similarly, local suppliers and vendors suffered the same fate, as their operations were also affected by positive COVID-19 cases in

their organizations. This supply chain disruption affected the overall performance of the projects, thereby delaying most construction projects across the UAE (Ghandour, 2020).

Q2. Did you develop a new schedule baseline and were solutions adopted to achieve the targets?

Contractors were the first to formally notify clients, consultants and other stakeholders about the prevailing situation and possible delays. At the time the pandemic started, the current stage of the project was a major factor when implementing a revised schedule's baseline and agreeing on a new completion date. Participants identified three strategies to address the new completion dates. First, projects in the initial execution stage were inclined to submit a revised schedule baseline by transferring the impact of COVID-19 to the end of the project's lifecycle. Second, partially completed and nearly completed projects applied for an extension of time (EoT) to accommodate the delays caused by the pandemic, without modifying the existing schedule's baseline. Participant P6 stated that, earlier, their project was supposed to be completed by March 2021. After submitting the EoT and obtaining approval, their revised completion date moved forward to October 2021. Finally, completed projects were given the flexibility or an extension to conduct the necessary testing, commissioning and handing over to the end-user.

Participants identified and discussed four major categories to reduce the pandemic's impact and complete projects: manpower, material, equipment and finances, as identified by Alsharef *et al.* (2021). First, as soon as the pandemic hit, authorities in the UAE encouraged a "work from home" policy, and all organizations across the country followed it to minimize the spread of the virus among their employees. Participant P4 stated,

> All our meetings and interactions were shifted to online platforms and we were using Microsoft Teams. Our Information Technology (IT) department did a great job and enabled us to perform our duties from the comfort of our homes during these difficult times.

Some organizations followed a 15-day rotation period by dividing their teams in half and asking half the team to go to the office for 15 days and then switch with the other half. Some organizations asked their office staff to go to the office for a short period, attend short meetings, collect their tasks and return home to work remotely for the rest of the time. Similarly, on-site labor accommodations, special travel arrangements and limited work-site attendance with multiple shifts allowed continuous execution of works during this pandemic, as identified by participant P5. Second, to address the shortage of materials imported from abroad, all stakeholders discussed using alternate materials that were readily available in the country, most of which were approved by allowing design changes. Rates were modified accordingly. Participant P1 stated,

> Earlier, we wanted better Granite finishes, which were being imported from Italy and took usually 3 months to be delivered. Now, to reduce the delays, we are agreeing to modify the design and adapt to readily available solutions, like marble or ceramic finishes.

Third, participants noted that most of the machinery and equipment used in the UAE construction industry came from China and Europe. Contracting firms were officially notified of this problem. After a series of meetings with consultants, on a case-by-case basis, already available equipment was allowed to be used. Finally, all participants mentioned that additional funds were assigned specifically to address the pandemic situation and steer projects away from the adverse impacts of COVID-19. All these discussed measures were implemented with variations, and they helped reduce anticipated delays.

Q3. How did COVID-19 affect the planning of future projects?

As per industry reports and internal studies, the UAE construction industry predicted another wave of the COVID-19 pandemic. Participant P1 stated,

> When the industry mentioned the second wave, the analytics were not talking about another spread of the virus; rather, they were referring towards the cash flow and contractual shocks that could result from this pandemic.

The organizations considered various factors while planning their future projects. For example, the earlier assumed time duration for slab-to-slab activity was 21 days; currently, most developers consider more realistic durations, such as 30–45 days, to accommodate adverse impacts and avoid legal consequences. The participants emphasized the fact that all lessons learned from this pandemic should be considered when planning future projects, including regarding human resource reserves, alternate materials and equipment arrangements, flexible construction schedules and financial margins to absorb the impacts of similar situations. All these factors should be investigated during the planning phase and must be included in the risk identification and assessment process to ensure that the respective mitigation plans have the provisions and capacity to address such events in the future (Casady and Baxter, 2020).

Project cost

Summary of results. The economic decline owing to the COVID-19 pandemic adversely affected the supply chain and posed serious cash flow implications that cannot be underestimated. Banks and other lending agencies stopped payments to carry out various risk assessments and implement risk mitigation strategies; thus, owners delayed payments to main contractors, which had a drastic domino effect on associated businesses. Everyone understood the scale of the pandemic and accepted the reality. Instead of harsh notices and legal actions, all parties showed flexibility and adapted to the situation to a reasonable extent. All the participants indicated that the cash flow impacts were significant but manageable.

Q4. How has COVID-19 impacted worker's salaries and project cash flows and associated payments from clients to main contractors, sub-contractors, vendors and suppliers?

This question garnered three different responses categorized as follows:

(1) timely payments;

(2) partial timely payments; and

(3) delayed payments.

Participants identified that government agencies handled the pandemic well, as most government projects had approved budgets for the fiscal year 2020. Given the availability of the budgets, all payments were made on a timely basis to all contractors, subcontractors, suppliers, vendors and employees alike. Payments from government agencies were also delayed, not because of a lack of funds but because of the disruption caused to normal operations when everyone stopped going to work and finance teams faced difficulties in getting the approved invoices from consultants and contractors, preparing payments and obtaining the required signatures within the stipulated time. In other development and

infrastructure projects, payments were delayed from main contractors to sub-contractors, vendors and suppliers, because most such payments were linked to pre-set milestones and deliveries of various items that were not realized because of the restrictions imposed for the pandemic. For imports, payments were linked to letters of credit (LCs), and LC conditions were not being met because of COVID-19 disruptions; thus, payments were stopped. In this scenario, most firms paid full salaries to their employees (Khalfan and Ismail, 2021). Finally, all the participants indicated that real-estate developments were adversely affected, because most end-users stopped receiving payments from banks and lending agencies and even their salaries. Thus, payments were stopped from developers to main contractors, which disrupted the overall supply chain and resulted in downsizing and salary cuts. All stakeholders understood the situation and negotiated various strategies to curb the impacts of the pandemic and address the delayed payments.

Q5. What volume of cost overruns are expected, and who will bear these losses?

The estimation of cost overruns required detailed analysis and assessment of the situation by identifying the key factors and their respective effects on every activity present in the work breakdown structure. All participants indicated that clients were notified about potential risks and associated delays; additionally, they were told that detailed risk quantification would be subsequently submitted. Different strategies were proposed and implemented by stakeholders to address the cost overruns and reduce their impact on the overall cost of the project. Participant P6 mentioned that they implemented an innovative method in the organization and asked their sub-contractors, vendors and suppliers if they wanted quick payments without achieving pre-set milestones; if so, they should announce discounts. In that way, the associated stakeholders received the required payments to effectively conduct their operations and survive the pandemic, and the main contractor saved funds to cover the additional costs incurred to curb the impacts of COVID-19. Some suppliers and vendors agreed to the offer, but others rejected it. Participant P6 stated that their organization successfully convinced the clients and modified their contract type from lump-sum to cost plus a fixed fee. Additionally, all the participants identified factors that could accommodate cost overruns. For example, given the downsizing, labor availability increased and, as a result, the cost of labor dropped, which to some extent addressed labor shortages during critical times. Additionally, given the uncertainty, many organizations increased their risk appetite and reduced their profit margins to secure jobs and strengthen their positions during the pandemic. All of these identified strategies and methods significantly reduced the impact of COVID-19 on project cost overruns.

Q6. How did banks and other lending agencies modify their policies?

All of the participants highlighted the fact that as the pandemic hit the UAE, banks and other lending agencies halted payment issuances. In the early months of the pandemic, banks reevaluated their risk management strategies and implemented more regulations for funding construction projects. “At the time, it was difficult to even secure performance guarantees from the banks,” participant P6 stated. To ease financial troubles and support economic activities throughout the country, the Central Bank of the UAE (CBUAE) announced the Targeted Economic Support Scheme (TESS), which encouraged almost all banks to come forward and join the relief efforts (CBUAE, 2020). TESS pumped in approximately AED100bn, which was subsequently increased to AED256bn, to support private sector companies and other private customers. Multiple relief measures were introduced to support the UAE construction industry, such as a liquidity relief fund of

AED50bn through local banks to support eligible customers. These customers were not required to pay the banks any principal amounts or make interest payments for the agreed deferment period. The account opening duration was set to two days, and minimum payment requirements were scrapped temporarily. This supported the UAE construction industry and helped it revive its former glory.

Project resources

Summary of results. The COVID-19 pandemic affected all aspects of construction projects and disrupted resource availability and management the most severely (Jallow, 2020). The UAE construction industry was highly reliant on human resources, materials and equipment being imported from all over the world. Therefore, strict lockdowns, travel bans and other stringent measures to curtail the disasters resulting from the pandemic adversely impacted resource availability and the management aspect of almost all construction projects across the country. Various relaxation measures from the authorities, the positive attitude of all stakeholders, different design modifications and the acceptance of using available resources helped relatively reduce the overall impact and absorbed the delays.

Q7. How did COVID-19 affect resource availability and management?

This question garnered various responses that can be grouped into three major categories: a) availability of labor (human resource), b) availability of materials and c) availability of equipment. Most staff in the UAE is hired primarily from Asian countries. Some of these employees were out of the country on vacation and for other official purposes when the pandemic struck. Given the suspension of visa issuances and international travel bans to contain the COVID-19 spread, people could not return to the UAE and continue their jobs. Many labor camps in the country were also severely affected, and most workers were in quarantine. Similarly, most of the materials and equipment were being imported from the Far East, Europe and the USA, where production facilities and international flights were affected, as stated by Baldwin and Mauro (2020). Many subcontractors, vendors and suppliers were unable to continue offering their services because of the identified issues and, as a result, execution of most projects across the country was delayed.

Q8. How were projects managed with low labor, material and equipment availability?

All participants identified that the UAE authorities had modified regulations and allowed contractors to set up on-site labor accommodation facilities instead of a designated labor camp. This measure reduced the need for special care to practice social distancing measures and arrange for special transportation, also suggested by Ahani and Nilashi (2020). As a result, labor and staff were less prone to the risk of contracting the virus. Additionally, relaxations announced by the authorities for inter-emirate travel eased the pressure, as many workers traveled from Abu Dhabi to Dubai in response to the market demand. Participant P1 stated that their organization had modified its policy of hiring sub-contractors. They had defined the "availability of labor" as high risk and prepared their mitigation plan accordingly. While hiring, they specifically searched for readily available labor and made deals with those who did not require new hiring. Long lists of terminations from human resource departments across the country also absorbed the disruption in the supply and demand to some extent. Moreover, various design modifications were made to accommodate the supply chain disruptions and reduce delays. Participant P2 stated that their organization previously required all electrical fixtures to be imported from various European countries. To reduce delays in projects, they relaxed this requirement and allowed

the use of locally made or locally available fixtures after receiving the end-users mutual consent. All the participants noted similar solutions to equipment unavailability.

Contracts

Summary of results. All participants indicated that current contracts did not have clauses that effectively addressed the pandemic situation, and the impacts of COVID-19 made project execution "burdensome." Force majeure clauses were introduced by most execution parties, and special amendments were suggested and implemented to address the situation. Local authorities also introduced a series of amendments to the law, relaxations and subsidies to support stakeholders. Participants suggested that all stakeholders should conduct detailed studies on the current situation and consider such pandemics and other COVID-19-related events in their future scope of work and contracts.

Q9. How did prevailing contract clauses handle this pandemic situation, and what were the suggested amendments to address the situation?

To analyze the utility of contract clauses, a participant indicated that in the UAE, under normal circumstances, the construction industry is generally driven by FIDIC contracts. In these contracts, some clauses outline methods and guidelines to deal with the situation, such as Clause 8 Sub-clauses 8.4 and 8.7 and Clause 19 Sub-clauses 19.1 and 19.4. However, these clauses failed to efficiently address the pandemic situation because such impacts had not previously occurred and were unanticipated. Participant P1 indicated that the force majeure clause was most relevant, and many parties added this clause to early notices to clients and consultants, as identified by Casady and Baxter (2020). However, this pandemic caused operational disruptions all across the globe and not merely for one project or locality; thus, prevailing contract clauses failed to address the impacts.

All participants indicated the positive attitude of all stakeholders. Participant P6 stated, "We have incorporated the COVID-19 pandemic into the existing force majeure clause so that these situations won't affect our projects in the future." Many amendments were made to existing contracts to accommodate the agreed-on revised completion dates, payment methods, project delivery methods, requirements for a specific number of skilled people, liquidated damages, material and equipment specifications, authority approvals and inspection methods. For example, participant P1 pointed out that they previously had a requirement of six quality assurance and quality control engineers in the contract. Subsequently, this number was reduced to three because of social distancing measures and the non-availability of skilled workers. Similarly, some organizations modified their contract type from lump-sum to cost plus a fixed fee. Some organizations also announced incentives related to liquidated damages and reductions in fines if contracting firms finished projects within the stipulated timeframe. The positive attitude and friendly amendments to the prevailing contracts proved fruitful in steering the construction industry out of the dire situation caused by the pandemic.

Q10. Were any guidelines issued by international contract institutes and local authorities to curtail contractual issues specific to COVID-19?

In response to inquiries about the guidelines issued by international contract institutes and local authorities, all the participants agreed that both the international and local authorities took prompt actions to address the situation and channelized the construction industry in a better direction. One of the participants, who was an expert in contracts, mentioned that the FIDIC released a memorandum that discussed various scenarios and suggested possible

solutions to address the pandemic (FIDIC Guidance Memorandum, 2020). Even though the contracts were driven by FIDIC guidelines, the local laws of the land prevailed in dealing with the COVID-19 pandemic, and all participants identified the importance of the civil law of the UAE. Local authorities introduced many guidelines to protect and safeguard this vital industry and the people associated with it. Even during the lockdown, the construction industry was exempted from the restrictions issued by local authorities. The Dubai Development Authority introduced various measures to support construction activities in the emirate, including the creation of digital platforms for a variety of permits, processes, approvals, licensing and attestations. They also introduced various relaxations in the payment of dues and fees to government authorities and extended building permits, fit-out permits, temporary construction permits and other related permissions for the three months. To observe social distancing measures and continue construction activities, virtual inspections of construction sites were introduced that allowed inspectors to inspect work sites at the various stages of construction using Microsoft Teams and Zoom. The Ministry of Human Resource and Emiratisation (MoHRE) permitted on-site construction labor accommodations and facilities to keep workers safe. The Government of Abu Dhabi also introduced 16 dynamic initiatives under the country's economic stimulus package that waived off the requirement to submit bid bonds and performance guarantees for start-ups. Various subsidies were also given, and penalties were waived. The participants stated that all these changes in local laws, whether at the federal or individual emirate level, prompted stakeholders to issue change-of-law notices to each other and ask for relevant concessions and amendments in prevailing contracts.

Working with standard operating procedures

Summary of results. The COVID-19 pandemic disrupted normal operations across all industries, and people feared contracting the virus. All international and local authorities announced various SOPs to contain the virus. The MoHRE issued a ministerial decision on precautionary measures, which described key SOPs to be followed in different work environments. The construction industry quickly followed the instructions by investing in the required personal protective equipment and other necessary items to measure, monitor and control the spread of the virus. All the participants reported that all the measures were implemented at all worksites and offices, as per local authorities' directions. Initially, these measures affected overall work performance, and other delays occurred, because the management and workers were still getting used to the changes. Subsequently, everyone adjusted to these SOPs, and progress became normal. Enforcement of the new SOPs to curtail the spread of COVID-19 proved effective and allowed the construction industry to continue operating during the pandemic.

Q11. What were the key SOPs issued by the authorities for the construction industry, and how did they affect overall performance?

In response to the identification of the key SOPs issued by the authorities for the UAE construction industry, all the participants grouped their responses into the following two categories:

(1) employer's obligations; and

(2) employee's obligations.

The authorities instructed immediate reduction in the number of employees to 30% in a workspace to ensure the required social distancing. All employers were asked to modify

their labor accommodations to ensure safe living conditions by providing various checkpoints at all entrances and exits, avoiding all gatherings and social events, maintaining only 25% occupancy on all worker transports, and reporting all cases of potential symptoms to the concerned authorities. All employers were asked to implement a remote working system and provide necessary electronic support to enable all workers to efficiently conduct their duties. Participant P4 stated that the authorities also instructed employers to approve the remote working systems for workers over 50 years of age, people of determination, workers suffering from respiratory or chronic diseases and women with children. Similarly, these guidelines instructed employees to obtain approval for a remote working system, visit their workplaces when required, perform all assigned duties within the stipulated timeframe, answer all calls and emails to ensure smooth execution and observe the productivity and confidentiality guidelines set by their employer. All participants mentioned that these SOPs initially slowed down workers' overall performance and, as a result, construction project performance (Stiles *et al.*, 2021). Once organizations implemented the required systems and workers became accustomed to the new normal, project performance improved and overall positive feedback was received.

Q12. How did the industry ensure the measures announced by the authorities?

When focusing on investigating how the construction industry ensured the successful implementation of the precautionary measures announced by the local authorities, the respondents identified several organizational measures to achieve the stated target. Participant P6 stated that their organization announced a separate budget to purchase masks, gloves, sanitizers, thermometers, thermal scanning equipment, walkthrough sanitization gates and handheld spraying equipment, also identified by Amoah and Simpeh (2020). Participant P3 identified that their organization made special transportation arrangements and built special on-site worker accommodations following the introduced social distancing measures. Also identified was that strategies were implemented to ensure on-site social distancing, such as dividing workers into smaller groups and tasking them to work at various distanced places where possible, rather than deploying a large number of workers to one place. Different timings for breaks were announced to prevent large gatherings at lifts, entrances and exits, dining halls and other facilities. Emails, awareness banners, circulars and instructions were continuously shared among the management and workers. Training on safety measures was conducted. Furthermore, various monitoring teams were assigned the task of monitoring offices and worksites to ensure that precautionary measures were being followed. Participant P1 explained the budgetary requirements to arrange all necessary items, tools and equipment to ensure a safe working environment. This respondent said,

> Earlier, everybody was working with full capacity, and contracts required a certain number of staff members and workers on-site as well. Now, contracting firms are working with reduced staff, and they are diverting their surplus operational budget to purchase the required items.

The participant also indicated that organizations arranged special quarantine facilities to keep workers for a certain period before allowing them to go back to work. The company immediately referred their suspected cases to the designated government COVID-19 health centers. All identified measures taken by the construction industry to ensure a safe working environment for workers and staff proved effective and helped the industry thrive in these difficult times.

Normalization, pandemic-proof policies and future directions

Summary of results. The exemptions and relaxations specifically for the construction industry, economic support programs and precautionary measures introduced by local

authorities enabled the construction industry to recover from the disruptions caused by the COVID-19 pandemic. Everyone quickly accepted the situation and adapted their behavior accordingly. Most participants stated that the construction industry has almost recovered and is expected to re-achieve its full potential within the next three-six months. The participants suggested that the lessons learned should be carefully recorded and considered when preparing risk assessment and mitigation plans, contingency plans, formal agreements, supply orders and contracts for future projects.

Q13. By when do you expect normalization, and what will be the new normal for the industry?

All participants responded optimistically to the inquiry about the normalization of the current situation. Participant P4 stated that, although there were struggles, some organizations were halfway to normalization. Furthermore, participants P1 and P2 mentioned that many contracting companies had achieved a new normal and were working at their full potential. Participant P2 even stated that their excellent planning and integration of technology-enabled their organization to complete one iconic project ahead of schedule during the pandemic. Therefore, the UAE construction industry expected normalization soon, and their optimism pointed toward the fact that normalization was near.

The participants also mentioned that accepting the pandemic situation was vital. Organizations that realized this fact early on were among those that handled the pandemic situation most efficiently and hence survived. Participant P1 stated,

> The best move to tackle the situation is to accept the reality and form a normal relationship with this pandemic, because sooner or later, people will have to adjust their lives according to the situation at hand.

The participants pointed out that many organizations modified their operating procedures according to the requirements and regulations imposed by the authorities to survive the pandemic situation, such as a sudden digital transformation. In a nutshell, the respondents emphasized that flexibility in accepting the current situation and molding their behavior as per the needs of the situation are expected to be the key success factors for the construction industry in the foreseeable future.

Q14. How do you view the future of construction projects, and what policies can we adopt to minimize the impact of such events?

Economies worldwide took a hard hit because of the disruptions caused by the COVID-19 pandemic. The construction industry depends heavily on government agency expenditures on different infrastructure projects. The disruptions caused by the pandemic forced governments worldwide to spend heavily on containing it and support their economies through a variety of economic stimulus packages. As a result, the construction industry slowed down, as did other industries. The participants indicated a significant decline in the number of tenders being floated by agencies. Participant P1 stated that because opportunities are scarce, contracting organizations should remain focused and rearrange their resources. However, all participants were optimistic and indicated that the government had announced various infrastructure packages that would be directed to local businesses. While recommending policies that could be adopted to minimize the impacts of such future pandemics, participant P10 identified that their organization prepared in advance its resources for the next six-eight months. Participant P6 indicated that this pandemic situation should be included as an employer risk in all future contracts, and special cost

contingencies must be assigned for similar situations. All the participants agreed that lessons learned should be properly examined and considered when planning and formulating future contracts.

As per the input provided by the participants, Figure 2 displays the timeline that represents the stages of COVID-19 in the UAE and the occurrence of the events scheduled from January 1, 2020, to December 31, 2020. The timeline is divided into three significant periods: a) pre-COVID-19, b) peak COVID-19 and c) recovery. In the pre-COVID-19 period, the construction industry performed normally and targets were being met as per expectations. The peak-COVID-19 period started with the WHO declaring COVID-19 a pandemic. Local authorities promptly responded to the situation at hand and announced various economic stimulus packages to support the industry during these difficult times (Ghandour, 2020). After the completion of the national sanitization drive and partial resumption of international flights, the UAE construction industry entered a recovery period, as shown in the timeline.

Pandemic and digital transformation

The construction industry is slow to adopt innovative technologies and engage in digital transformation and is perceived as being stuck with old business models and practices (Takim *et al.*, 2013). Many IT-enabled tools are available that have proven their effectiveness and reliability in achieving the successful execution of construction projects; examples include BIM (Sami Ur Rehman *et al.*, 2020), virtual design and construction (Shafiq and Afzal, 2020), radio frequency identification (RFID) (Chen *et al.*, 2020), 3D printing (Arunothayan *et al.*, 2020) and Internet of Things (IoT) (Panteli *et al.*, 2020). The COVID-19

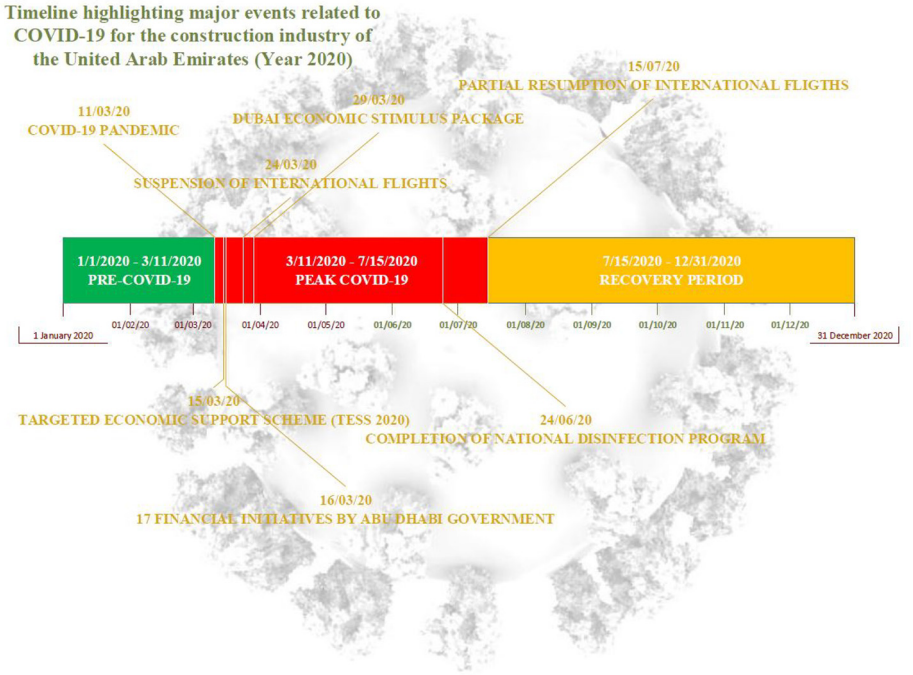

Figure 2
Timeline of major events related to COVID-19 for the UAE

pandemic forced the construction industry to quickly adapt available technologies and encouraged it to embrace the required digital transformation.

The participants identified that the UAE construction industry successfully implemented different IT-based tools and techniques to reduce the number of workers at sites and allowed their teams to work remotely. One participant mentioned that their organization introduced various artificial intelligence-enabled tools and stated,

> AI is playing a positive role in reducing the number of construction personnel, and COVID-19 accelerated the implementation of some practices which were previously under evaluation. For example, BIM (Level 1 and Level 2), 360 videos, drone surveillance, RFID, Bluetooth Low Energy, and cloud-based coordination, in addition to design and build and off-site fabrication for Mechanical, Electrical, and Plumbing (MEP) are tools that are now readily being accepted as part of construction workflows.

This pandemic has already changed the norms of the construction industry and has encouraged all stakeholders to take big steps, adopt digital tools and undergo digital transformation. Another participant indicated that their organization successfully implemented and benefited from augmented reality, Building Information Modeling, IoT and various cloud-based monitoring and management solutions. All participants agreed that this pandemic was a blessing in disguise for the construction industry's indispensable shift to digital transformation.

Conclusion

The COVID-19 pandemic caused disruptions in usual functioning patterns around the world. The rapid spread of the virus significantly affected the normal operations of the construction industry.

The spread of the pandemic interrupted international travel, forced stringent lockdowns, initiated sanitization drives and fueled the announcement of all other precautionary and preventive measures and restrictions by authorities, delaying construction projects across the country, which further resulted in financial losses; restricted the availability of human resources, materials and equipment; invalidated current contracts and agreements; forced the industry to follow novel SOPs; and dimmed the future of the billion-dollar construction industry.

However, the positive attitude of all stakeholders in accepting the prevailing situation, the announcement of contingency budgets, modification of specifications for available resources, mutual agreements to various contractual changes to positively address the situation, compliance with and adjustment to precautionary and preventive measures announced by authorities to curtail the spread of the virus and rapid transformation of the industry to a digital workplace brought hope and steered the construction industry on the right path to recover from the disruptions caused by the COVID-19 pandemic.

Moreover, the authorities' relaxations and exemptions announced for the construction industry and the efficient economic support schemes also proved effective and supported the industry during this difficult period.

This study concludes that the COVID 19 pandemic has changed the working practices of the construction industry in the UAE in many ways. The construction projects in the UAE quickly adopted the new working norms and showed flexibility in absorbing the impact of delays and cost overruns through effective contractual changes and support from financial institutes in the country. The UAE government's economic support programs precautionary measures and health-care system have played a major role in the return of the construction workforce, helping the construction projects performance to recover from the impact of

pandemic imposed delays and disruptions. The construction industry in the UAE has shown a strong drive during the pandemic to adopt digital tools and methods (i.e. BIM, remote project monitoring and management, cloud-based collaboration) to manage construction projects.

The findings of this study document the impact of COVID-19 on various aspects of construction projects along with the industry response to manage and mitigate the impact on project performance metrics. This provides valuable insight for the AEC industry professionals to adopt proactive measures to manage new, and existing, projects in the light of a continued pandemic.

References

Abdullahi, M., Bala, K. and Bala, K. (2018), "Analysis of the causality links between the growth of the construction industry and the growth of the Nigerian economy", *Journal of Construction in Developing Countries*, Vol. 23 No. 1, pp. 103-113.

Ahani, A. and Nilashi, M. (2020), "Coronavirus outbreak and its impacts on global economy: the role of social network sites", *Journal of Soft Computing and Decision Support Systems*, Vol. 7 No. 2, pp. 19-22.

Al-Ameri, A., Nasaruddin, N.A.N. and Memon, A.H. (2020), "Effects due to change in UAE construction projects", *International Journal of Sustainable Construction Engineering and Technology*, Vol. 11 No. 2, pp. 118-125, available at: https://publisher.uthm.edu.my/ojs/index.php/IJSCET/article/view/7378 (accessed 29 November 2020).

Al-Malkawi, H. and Pillai, R. (2013), "The impact of financial crisis on UAE real estate and construction sector: analysis and implications", *Humanomics*, Vol. 29 No. 2, pp. 115-135.

Alsharef, A., Banerjee, S., Uddin, S.M.J., Albert, A. and Jaselskis, E. (2021), "Early impacts of the COVID-19 pandemic on the United States construction industry", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 4, pp. 1-21.

Amoah, C. and Simpeh, F. (2020), "Implementation challenges of COVID-19 safety measures at construction sites in South Africa", *Journal of Facilities Management*, Vol. 19 No. 1, pp. 111-128.

Arunothayan, A.R., Nematollahi, B., Ranade, R., Bong, S.H. and Sanjayan, J. (2020), "Development of 3D-printable ultra-high performance fiber-reinforced concrete for digital construction", *Construction and Building Materials*, Vol. 257, pp. 119546, doi: 10.1016/j.conbuildmat.2020.119546.

Baldwin, R. and Mauro, B. (Eds) (2020), *Economics in the Time of COVID-19*, *CEPR* Press: a VoxEU.org eBook.

Barriball, K.L. and While, A. (1994), "Collecting data using a semi-structured interview: a discussion paper", *Journal of Advanced Nursing*, Vol. 19 No. 2, pp. 328-335.

Baveja, A., Kapoor, A. and Melamed, B. (2020), "Stopping COVID-19: a pandemic-management service value chain approach", *Annals of Operations Research*, Vol. 289 No. 2, p. 1.

Baycar, H. (2020), "The sudden cost of unexpected threats: the novel coronavirus and Dubai",

BBC (2010), "World's tallest building opens in Dubai' [online]", available at: http://news.bbc.co.uk/2/hi/8439618.stm

Casady, C.B. and Baxter, D. (2020), "Pandemics, public-private partnerships (PPPs), and force majeure | COVID-19 expectations and implications", *Construction Management and Economics, Routledge*, Vol. 38 No. 12, pp. 1077-1085.

Caulkins, J., Grass, D., Feichtinger, G., Hartl, R., Kort, P.M., Prskawetz, A., *et al.* (2020), "How long should the COVID-19 lockdown continue? ", *PLoS One*, Vol. 15 No. 12, p. e0243413, doi: 10.1371/journal.pone.0243413.

CBUAE (2020), "Standards for the Central bank of the UAE's targeted economic support scheme (TESS)",

Chan, A.P., Scott, D. and Chan, A.P. (2004), "Factors affecting the success of a construction project", *Journal of Construction Engineering and Management*, Vol. 130 No. 1, pp. 153-155.

Chen, Q., Adey, B.T., Haas, C. and Hall, D.M. (2020), "Using look-ahead plans to improve material flow processes on construction projects when using BIM and RFID technologies", *Construction Innovation*, Vol. 20 No. 3, pp. 471-508, doi: 10.1108/CI-11-2019-0133.

Chen, Q., Nie, G., Yan, B. and Huang, Y. (2020), "Mental health burden for Chinese middle school students affected by the COVID-19 pandemic", *Asian Journal of Psychiatry*, Vol. 54 No. 3002, pp. 102251, doi: 10.1016/j.ajp.2020.102251.

Daleure, G. (2017), *UAE Goes Global, in Emiratization in the UAE Labor Market*, *Springer*, Singapore, pp. 7-26.

Denny-Smith, G., Sunindijo, R.Y., Loosemore, M., Williams, M. and Piggott, L. (2021), "How construction employment can create social value and assist recovery from COVID-19", *Sustainability (Switzerland)*, Vol. 13 No. 2, pp. 1-20.

Dubai Chamber of Commerce Study (2012), "Dubai, December", available online: www.dubaichamber.com/whats-happening/chamber_news/construction-sector-to-contribute-11-1-to-uae%E2%80%99s-gdp-in-2015 (accessed 24 September 2020).

El-Sayegh, S., Ahmad, I., Aljanabi, M., Herzallah, R., Metry, S. and El-Ashwal, O. (2020), "Construction disputes in the UAE: causes and resolution methods", *Buildings*, Vol. 10 No. 10, p. 171.

Enshassi, A., Al Swaity, E. and Arain, F. (2016), "Investigating common causes of burnout in the construction industry", *International Journal of Construction Project Management*, Vol. 8 No. 1, p. 43.

Faridi, A. and El-Sayegh, S. (2006), "Significant factors causing delay in the UAE construction industry", *Construction Management and Economics*, Vol. 24 No. 11, pp. 1167-1176.

FIDIC Guidance Memorandum (2020), "FIDIC COVID-19 guidance memorandum to users of FIDIC standard forms of works contract. April",

Ghandour, A. (2020), "The impact of COVID-19 on project delivery: a perspective from the construction sector in the United Arab Emirates", *Humanities and Social Sciences Reviews*, Vol. 8 No. 5, pp. 169-177.

Jallow, H. (2020), "The impact of COVID-19 outbreak on United Kingdom infrastructure sector", 10.1108/SASBE-05-2020-0068.

Johnson, R. and Babu, R. (2018), "Time and cost overruns in the UAE construction industry: a critical analysis", *International Journal of Construction Management*, Vol. 20 No. 5, pp. 402-411.

Khalfan, M. and Ismail, M. (2021), "Engineering projects and crisis management: a descriptive study on the impact of COVID-19 on engineering projects in Bahrain", pp. 1-5.

Mashreq (2020), "UAE construction", Vol. 11.

Mehran, D. (2016), "Exploring the adoption of BIM in the UAE construction industry for AEC firms", *Procedia Engineering*, Vol. 145, pp. 1110-1118.

Muhammad, M.T. (2017), "Improving cost and time control in Malaysian construction industry using building information modelling", available at: http://psasir.upm.edu.my/id/eprint/70163/1/FK%202017%20102%20IR.pdf

Panteli, C., Kylili, A. and Fokaides, P.A. (2020), "Building information modelling applications in smart buildings: from design to commissioning and beyond a critical review", *Journal of Cleaner Production*, Vol. 265, p. 121766, doi: 10.1016/j.jclepro.2020.121766.

Rabionet, S.E. (2011), "How I learned to design and conduct semi-structured interviews: an ongoing and continuous journey", *Qualitative Report*, 563-566, available at: https://eric.ed.gov/?id=EJ926305.

Sami Ur Rehman, M., Thaheem, M.J., Nasir, A.R. and Khan, K.I.A. (2020), "Project schedule risk management through building information modelling", *International Journal of Construction Management*, pp. 1-11, doi: 10.1080/15623599.2020.1728606.

Saunders, M., Thornhill, A. and Lewis, P. (2019), *Research Methods for Business Students*, *Pearson Education*, Harlow, ISBN 9781292208787.

Shafiq, M.T. and Afzal, M. (2020), "Potential of virtual design construction technologies to improve job-site safety in Gulf corporation council", *Sustainability (Sustainability)*, Vol. 12 No. 9, doi: 10.3390/su12093826.

Statista (2020). "Global construction expenditure share forecast", available at: www.statista.com/statistics/561896/construction-spending-share-forecast-worldwide-by-region/

Stiles, S. Golightly, D. and Ryan, B. (2021), "Impact of COVID-19 on health and safety in the construction sector", No. August 2020, 10.1002/hfm.20882.

Takim, R., Harris, M. and Nawawi, A.H. (2013), "Building information modeling (BIM): a new paradigm for quality of life within architectural, engineering and construction (AEC) industry", *Procedia – Social and Behavioral Sciences*, Vol. 101, pp. 23-32, doi: 10.1016/j.sbspro.2013.07.175.

Teddlie, C. and Tashakkori, A. (2010), "Major issues and controversies in the use of mixed methods in the social and behavioural science", *Handbook of Mixed Methods in Social and Behavioural Research*, *Sage*, Thousand Oaks, ISBN: 9781412972666.

Wang, J. (2021), "Vision of China's future urban construction reform: in the perspective of comprehensive prevention and control for multi disasters", *Sustainable Cities and Society*, Vol. 64 No. September 2020, pp. 102511.

Weber, B. and Alfen, H.W. (2016), "Infrastructure as an asset class: investment strategies", *Project Finance and PPP*, *John Wiley and Sons*, *New York, NY*, ISBN: 978-1-119-22654-3.

Yam, K.C., Jackson, J.C., Barnes, C.M., Lau, T.C., Qin, X. and Lee, H.Y. (2020), "The rise of COVID-19 is associated with support for world leaders", doi: 10.31234/osf.io/jhprk.

Zahmak, A., Ghannam, O. and Nofal, O. (2020), "Comparative study between contractors' and consultants' evaluation of cost overrun factors in building construction projects in UAE", *2020 Advances in Science and Engineering Technology International Conferences (ASET)*. 10.1109/aset48392.2020.9118313

Further reading

Al-Tawfiq, J.A., Zumla, A. and Memish, Z.A. (2014), "Travel implications of emerging coronaviruses: SARS and MERS-CoV", *Travel Medicine and Infectious Disease*, Vol. 12 No. 5, pp. 422-428.

Batlle-Bayer, L., Aldaco, R., Bala, A., Puig, R., Laso, J., Margallo, M., Vázquez-Rowe, I., Antó, J.M. and Fullana-I-Palmer, P. (2020), "Environmental and nutritional impacts of dietary changes in Spain during the COVID-19 lockdown", *Science of the Total Environment*, Vol. 748, p. 141410, doi: 10.1016/j.scitotenv.2020.141410.

Glover, R.E., van Schalkwyk, M.C.I., Akl, E.A., Kristjannson, E., Lotfi, T., Petkovic, J., Petticrew, M.P., Pottie, K., Tugwell, P. and Welch, V. (2020), "A framework for identifying and mitigating the equity harms of COVID-19 policy interventions", *Journal of Clinical Epidemiology*, Vol. 128, pp. 35-48, doi: 10.1016/j.jclinepi.2020.06.004.

Howard, M.C. (2021), "Who wants to reopen the economy during the COVID-19 pandemic? The daring and uncaring", *Personality and Individual Differences*, Vol. 168, p. 110335, doi: 10.1016/j.paid.2020.110335.

Iata.org (2020), "1.7 million Middle east jobs will be lost due to COVID-19 and border closures. [online]", available at: www.iata.org/en/pressroom/pr/2020-10-01-02/ (accessed 25 November 2020).

Lai, C.-C., Shih, T.-P., Ko, W.-C., Tang, H.-J. and Hsueh, P.-R. (2020), "Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): the epidemic and the challenges", *International Journal of Antimicrobial Agents*, Vol. 55 No. 3, p. 105924, doi: 10.1016/j.ijantimicag.2020.105924.

McKinsey global institute (2020), "Reinventing Construction. [online]", available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our

%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-Construction-In-Brief.ashx (accessed 25 November 2020).

Wang, T., Du, Z., Zhu, F., Cao, Z., An, Y., Gao, Y. and Jiang, B. (2020), "Comorbidities and multi-organ injuries in the treatment of COVID-19", *The Lancet*, Vol. 395 No. 10228, doi: 10.1016/s0140-6736(20)30558-4.

Who, W.H.O. (2020), 'WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020', WHO Director General's speeches, (March), p. 4, available at: www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020.

Wu, J.T., Leung, K. and Leung, G.M. (2020), "Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study", *The Lancet*, Vol. 395 No. 10225, pp. 689-697, doi: 10.1016/S0140-6736(20)30260-9.

Yashavantha Rao, H. and Jayabaskaran, C. (2020), "The emergence of a novel coronavirus (SARS-cov-2) disease and their neuroinvasive propensity may affect in COVID-19 patients", *Journal of Medical Virology*, Vol. 92 No. 7, pp. 786-790, doi: 10.1002/jmv.25918.

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