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**Adapting to Change: Redefining Employee Utilization in  
Construction Projects through Lessons Learnt from COVID-  
19**

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# Adapting to Change: Redefining Employee Utilization in Construction

## Projects through Lessons Learnt from COVID-19

### Abstract

**Purpose:** The study aims to understand the challenges of effective employee utilization in construction projects during the COVID-19 pandemic in a developing country and to develop mitigation strategies for post-pandemic workforce management.

**Research Design/Methodology/Approach:** We used a qualitative research design to conduct semi-structured interviews with elite informants of various construction firms and analyze the data using thematic analysis.

**Results:** The results showed that numerous factors, including supply chain issues, inadequate worker healthcare, ineffective knowledge management, and job losses, have negatively impacted the construction industry. The prominent outcomes of the study are a conceptual framework for effective workforce management post-pandemic and beyond, including recommendations for managers and executives and future research.

**Originality/Value:** The workforce management framework with knowledge management developed in this study provides a new theoretical view of post-pandemic mitigation strategies through the theoretical lens of dynamics capabilities and knowledge management. The findings cover industrial insights, particularly from the stakeholders' perspective, and provide a solid foundation for future research in this domain.

**Keywords:** COVID-19, Construction Industry, Employee Utilization, Workforce management

## 1. Introduction

In 2019, COVID-19 struck the entire world and ushered in anarchy as one of the biggest challenges of the twenty-first century (Duan et al., 2021; Teng et al., 2021). It was first reported in the city of Wuhan, PR China, and declared by the WHO as a pandemic (Wang et al., 2022; Anholon et al., 2021). According to the WHO, over 200 million people were infected with COVID-19, and 4.25 million died as a result. This pandemic significantly affected people's daily lives and society (Bhatia, 2021). Specifically, the economy had a severe impact during this COVID-19 pandemic. Almost all countries faced recession and a steep economic decline because of this pandemic (Islam & Habib, 2022; Ritter & Pedersen, 2020; Yao & Azma, 2022). Countries implemented various methods to combat the virus's transmission, including social distancing, which required working from home, a travel ban, and smart lockdowns, to name a few (Gamil & Alhagar, 2020). Except for the medical sector, health monitoring systems, and food supplies, all other business activities were halted (Hui et al., 2020), and the construction industry was one of them (Garai & Ku, 2023).

The construction sector plays a critical role in a country's political, societal, and economic development and contributes to the GDP of a country's economy (Meng et al., 2021). Investment in construction and real estate are the primary building blocks to uplift the GDP growth (May 2020). COVID-19 has affected various operational aspects of the construction industry. For example, the trained labor shortage and significant changes in working environments are a few challenges this sector faces (McAllister et al., 2022; Biswas et al., 2021). Like other companies, the construction industry has also faced market disturbance and a decrease in private and government investment because of uncertainty brought about by the COVID-19 pandemic.

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3 Further, lockdowns and material and equipment shortages triggered the cancellation and  
4 suspension of projects (El Korchi, 2022). The suppliers had closed their operations, making the  
5 timely delivery of the required material impossible. Other issues include time, cost, and workers'  
6 layoffs. Extensive development is evident in the construction industry, especially after the  
7 pandemic, such as the adoption of artificial intelligence, the Internet of Things, and tools and  
8 concepts of industry 4.0 and 5.0 (Sumbal & Amber, 2024; Khurshid et al., 2023; Maqbool et al.,  
9 2023). The recent technological revolution has also been implemented in the construction industry  
10 (Hanifa et al., 2023; Olueye et al., 2023), though primarily evident in developed economies.  
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22 Pakistan is a developing economy where the construction industry is pivotal in lowering  
23 unemployment and developing an aggregate economy. It creates many employment opportunities  
24 because of its link with around forty building materials industries. The construction industry  
25 employs 7.61% of the workforce (Pakistan Economic Survey, 2019-20). In Pakistan, COVID-19  
26 also wreaked havoc and severely impacted various industries (Waris et al., 2020), including the  
27 construction sector. We have found studies on the impact of COVID-19 on the construction  
28 industry (e.g., Parr et al., 2020; Hansen, 2020; Assaad & El-Adaway, 2021; Pirzadeh & Lingard,  
29 2021). However, these are primarily focused on developed economies and cover variable aspects  
30 such as human travel behavior (Parr et al., 2020), the impact of lockdown on stakeholders from a  
31 financial and psychological perspective (Hansen, 2020), viewpoints and review papers to  
32 determine best practices and future directions in the construction industry (Assaad & El-Adaway,  
33 2021), the impact of teleworking on the well-being of managers in the construction industry  
34 (Pirzadeh & Lingard, 2021) among others.  
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51 An important aspect to consider is that COVID-19 had a variable impact on various  
52 geographical locations because of numerous factors, such as working environments, culture,  
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3 resources, and the severity of the pandemic (Sumbal et al., 2024; Al-Mhdawi et al., 2022). Hence,  
4 the role of context is vital, specifically when resource constraints are a big issue in specific  
5 contexts, such as developing economies. Moreover, existing studies must cover a holistic view  
6 concerning effective employee utilization at all levels, from laborers to top management, and  
7 workforce management through effective knowledge management. The construction sector in  
8 Pakistan employs almost 4.7 million workers, and thus, this sector has a higher impact on the  
9 country's economy. Thus, in this paper, we aim to examine the following research questions in the  
10 context of Pakistan, a developing economy with various resource constraints.  
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21 *RQ1: What employee utilization challenges did the construction industry face during the*  
22 *COVID-19 pandemic in a developing country context?*  
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24 *RQ2: What strategies could the construction industry adopt for effective employee*  
25 *utilization post-pandemic in a developing country?*  
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31 Through these research questions, we identify the risks brought by external factors to the  
32 construction industry and provide various indicators and solutions to enterprises to cater to these  
33 risks for effective decision-making. The results could be helpful in the industry to combat post-  
34 COVID-19 and future pandemic scenarios by ensuring the safety and productivity of the workers.  
35 Our study aims to support practitioners and policymakers in the construction industry by  
36 identifying various strategies to avoid such catastrophes in the future.  
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41 The paper proceeds with the literature review, followed by the methodology. After the  
42 methodology section, the following section presents the findings of the empirical investigation.  
43 This section demonstrates challenges in the construction industry and mitigating strategies. It then  
44 follows the discussion and analysis. The conclusion and theoretical and practical contributions are  
45 presented at the end of the paper.  
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## 2. Literature Review

### *2.1 COVID-19 and its Global Impact*

COVID-19 was initially considered pneumonia started at the end of December 2019 in Wuhan, a city in the central province of Hubei, in Mainland China. It then spread throughout China and worldwide within the next few months. The Centre for Disease Control (CDC) China analyzed the specimens and confirmed that the novel coronavirus was the cause of this pneumonia (Zhu et al., 2020). Later, WHO named the Coronavirus disease 19 (COVID-19) on 11th Feb 2020. Since its inception, numerous variants of COVID-19 have been discovered, the most recent being the Omicron variant. There was a drop in the overall cases after mid-2021 since the development and injection of the vaccine. However, the statistics kept changing based on the variants of COVID-19 affecting the populations in various parts of the world (Du et al. 2020). The impact of COVID-19 resulted in measures to cater to the spread of the virus. These measures had a long-lasting impact on societies and economies globally. There have been lockdowns in cities worldwide, restrictions on labor movement, traveling bans, suspension of airlines, and, most significantly, economic downturns (Bhatia, 2021). Particularly, COVID-19 hit developing countries because these countries have weak health infrastructures, unstable capital flows, and are often profoundly indebted (Al-Mhdawi et al., 2022).

After the pandemic, technological advancement accelerated the development of the construction industry (Khurshid et al., 2023). Artificial intelligence, the Internet of Things, and Industry 4.0 and 5.0 have changed the scenario in the construction industry (Hanifa et al., 2023; Olueye et al., 2023; Maqbool et al., 2023). The latest technological breakthrough, generative AI, is also facilitating developments in the construction industry (Rane, 2023). However, all such developments are extensively seen in developed countries (Hanifa et al., 2023; Olueye et al., 2023).

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3 Developing countries are required to enhance productivity by adopting and implementing  
4 technologically advanced methods and processes of construction, which is inevitable for  
5 successful construction project delivery (Kissi et al., 2023).  
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10 In Pakistan, the government took various steps to combat COVID-19 and provided the  
11 required facilities to the people (Batool et al., 2022). The steps included the earliest detection of  
12 cases, communication of the risk, social distancing, and quarantines to avoid COVID-19's spread.  
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14 The government established a COVID-19 relief fund to collect donations for public welfare (Waris  
15 et al., 2020). Hospital special units were established to provide 24-hour relief services to COVID-  
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17 19-affected patients. Many drastic measures taken by the government resulted in the closure of  
18 various organizations and the implementation of work from home policy (Batool et al., 2022).  
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20 Employee retention became a critical issue when the government issued lockdown orders in the  
21 country. To oversee this, the labor department of all provinces instructed companies to provide  
22 total wages to the employees and not terminate the employees. The construction industry is also  
23 affected as most work is fieldwork, and employees must work as teams on construction sites  
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25 (Oswald et al., 2020).  
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### 37 ***2.2 COVID-19 - Strategies and Challenges in Construction Sector***

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40 COVID-19 severely affected the operations of the construction industry (Brown & Claeys,  
41 2020). Shortage of skilled labor and unavailability of materials because of the lockdown are a few  
42 examples of the problems experienced by the construction industry (Gamil & Alhagar, 2020). Most  
43 of the construction projects were either suspended or delayed. Similarly, the suppliers involved in  
44 the materials' delivery were also affected, and their operations were delayed (El Korchi, 2022).  
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46 The unavailability of construction machinery also turned out to be an enormous problem. Also,  
47 construction workers had many positive cases compared to other industries, such as healthcare,  
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3 manufacturing, and transportation. Construction workers are also more likely to get hospitalized  
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5 than in other industries because of on-site risks (Gamil & Alhagar, 2020).  
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9 Pamidimukkala and Kermanshachi (2021) mentioned various challenges construction  
10 workers face, including psychological, organizational, individual, and economic factors. Further,  
11 they mentioned that it is essential to implement workforce protection, project performance  
12 protection, and project continuity to manage construction workers' health and safety challenges.  
13 Further, they mentioned that strategies such as social distancing, sanitization of workstations, and  
14 effective technology utilization would help in project productivity and keep the employees safe.  
15  
16 Ayat et al. (2021) conducted a systemized review of the literature in the construction sector  
17 regarding the effects of the COVID-19 pandemic. Their study revealed that many studies focused  
18 on the challenges and impact of COVID-19 on construction sites. Based on this literature review,  
19 they further developed recommendations to reduce the impact of the pandemic on the construction  
20 sector. These recommendations involve improving the safety guidelines, process improvement,  
21 psychological support, and technology adoption. Ogunnusi et al. (2020) reveal that the COVID-  
22 19 pandemic caused interruptions in workflow and supply chains, increased anxiety in workers,  
23 and new policy implementation issues in the construction sector. Combating these issues involves  
24 better procurement planning, virtual working, and social distancing. They also highlighted the  
25 importance of technology in combating these issues in the construction sector.  
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46 Raoufi and Fayek (2021) surveyed the North American construction industry. They found  
47 that it is essential to have regular communication and coordination among project teams and use  
48 technology to ensure that the construction projects keep on going. Complying with the health  
49 guidelines and implementing standard safety conditions and health monitoring measures is vital.  
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51 Zamani et al. (2021) argued that the role of the construction industry is significant in the growth  
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3 and economic development of the country. They interviewed 20 contractor companies in Malaysia  
4 involved in construction projects and found that construction companies faced financial and  
5 operational issues. Operational issues were regarding the project timelines, reduced labor, and  
6 logistic issues, whereas financial issues pertain to increased project cost, payment issues, and  
7 reduced number of projects. They mentioned a few strategies to manage these issues, for example,  
8 acquiring complete information regarding the SOPs and other related issues from the Governments  
9 and, secondly, looking for grants and funding from the local bodies to support the losses in the  
10 businesses.  
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22 Ghansah and Lu (2023) conducted a literature review of studies and found that most of the  
23 studies focused on the impact of COVID-19 on construction, and fewer studies discussed coping  
24 strategies. They categorized the main challenges in existing literature, which are cost and payment-  
25 related challenges, work-related challenges, procurement and supply chain-related challenges, site  
26 accessibility challenges, and digital technology-related challenges. They then categorized the  
27 responding strategies, including governmental policies, instructions, and organizational  
28 approaches. The organizational approaches involve many practices such as workforce  
29 management, risk management, technology adoption, prefabrication construction and lean  
30 construction, recycling, and health and safety management techniques. A few post-COVID-19  
31 interventions were also identified, such as implementing a change management model, business  
32 continuity strategies, sustainable practices, and changes in design and construction processes,  
33 mostly involving technology usage.  
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### 51 ***2.3 Workforce Management Practices in the Construction Sector Post COVID-19***

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53 Workforce management practices are part of the organizational practices for construction  
54 enterprises to reduce the influence of COVID-19 and other risks to the industrial sector. Bardhan  
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3 et al. (2022) tailored workforce management practices for several sectors, such as staggered work  
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5 schedules, keeping in-person meetings short, job hazard analysis, and setting physical barriers to  
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7 separate employees from the public, which are the best practices for the construction sector. Tan  
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9 & Abdul-Samad (2023) indicated that the workforce management practices for employee  
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11 productivity improvement adopted by Malaysian construction managers, such as using  
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13 communication technology and SOP compliance, are the significant actions managers take.  
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15 However, they speculated that practices such as applying time monitoring software and  
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17 implementing the Industrialized Building System (IBS) and Integrated Digital Delivery (IDD)  
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19 were less effective for workforce productivity due to the newness of the techniques and limited  
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21 awareness among the players in this industry. Niroshana et al. (2023) conducted a study in Sri  
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23 Lanka. They found that the top and middle levels of management in construction companies  
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25 changed the workforce composition to respond to COVID-19 by maintaining the same number of  
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27 workers but increasing the number of local workers and decreasing the foreign workers' quota.  
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29 From the perspective of lean construction, Jiang et al. (2023) discussed a workforce management  
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31 framework with the innovative "Worker's Home" practices (a place for construction workers with  
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33 a series of steady, safe, and humanistic living services and care), involving three progressive levels:  
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35 workforce mobility management, labor skill development, and labor productivity improvement,  
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37 which aims to achieve the mobility, labor career development, and productivity improvement.  
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39 Recently, Seneviratne et al. (2024) investigated the practices mapped with 'The Sendai Framework'  
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41 (TSF) implemented by Australian construction companies. Their study showed the different  
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43 adopted workforce management practices regarding the size of construction enterprises to reduce  
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45 COVID-19 risk. For example, the medium one uses a stated-based workforce, and the large one  
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47 emphasizes comprehensive communication among all workforce and segregates the workforce  
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3 into work on-site or at home. Thus, organizations must have a dynamic capability perspective to  
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5 combat unforeseen situations.  
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9         Dynamic capabilities (DCs) are defined as a firm's ongoing behavioral intention to  
10 integrate, reconfigure, renew, and recreate its resources and capabilities in a constantly changing  
11 environment for upgrading and reconstructing its core capabilities to attain and sustain competitive  
12 advantage (Wang & Ahmed, 2007). The sudden pandemic caused environmental changes, so  
13 actions were taken to cope with the dynamic change. Based on DCs and the context of COVID-  
14 19, Dejardin et al. (2023) found out the strategies shift of the SMEs from focusing on new  
15 opportunities to launching products to market for the performance. The SMEs with the DCs have  
16 the ability and the agility to adjust strategies to create value (Zahoor et al., 2022). Moreover, from  
17 the perspective of DCs, Muneeb et al. (2023) investigated how higher education institutions  
18 strategically responded to the pandemic. However, to the best of the author's knowledge, only a  
19 few studies have put insight into how and what strategies construction sectors could execute to  
20 mitigate the influence of the pandemic and avoid such turbulence through the theoretical lens of  
21 DCs. Cherian and Arun (2023) filled the research gap in dynamic capabilities by investigating  
22 certain construction firms. How they respond regarding a specific function, i.e., supply chain, but  
23 the discussions about other dimensions were missing. Chih et al. (2022) conducted a literature  
24 review to frame a roadmap for the construction sector to recover from COVID-19 through the lens  
25 of dynamic capabilities. Boamah et al. (2022) examined how Ghanaian construction firms  
26 responded to the pandemic, incorporating the knowledge creation but ignoring the other processes  
27 of KM.  
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### 53 **3. Methodology**

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3 The study aims to investigate the impact of COVID-19 on Pakistan's construction industry and  
4 workforce management during the pandemic, i.e., the nature of the study is to explore what are the  
5 employee utilization challenges and how the construction sector coped with these challenges using  
6 various strategies as well as insights to handle such challenges when the pandemic is over. The  
7 qualitative approach is practical when the phenomenon is under-explored, such as the novel  
8 COVID-19 phenomenon, and the research aim is to seek new insights into a specific context (Bruce  
9 & Berg, 2001). This study adopted a qualitative research design that considered the above  
10 arguments. The paradigm effectively allows this study to explore the challenges and develop  
11 corresponding strategies by interpreting the insights from construction professionals with years of  
12 experience. We set our study in a developing economic context, i.e., Pakistan.  
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### 27 ***3.1 Study Participants***

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30 Appropriate selection of the respondents is the key to successful qualitative research. Respondents  
31 must be the true representatives of the study phenomenon. This study focuses on the construction  
32 industry; therefore, participants working on various construction projects were selected carefully.  
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34 The selection criteria of Sumbal et al. (2017) opted for selecting experts who were elite informants  
35 from the construction industry. The main criteria used for the selection of experts were:  
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42 *i. They must have over ten years of experience in the construction industry.*
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44 *ii. They are above 30 years of age.*
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46 *iii. They have worked in managerial positions in the construction sector.*
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48 *iv. The chosen respondents worked in different departments of the construction industry*  
49 *and fulfilled the criteria above for an expert. Table 1 provides details of the*  
50 *respondents.*  
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## Insert Table 1

### 3.2 Data Collection–Experts’ Interviews

This study opted for semi-structured interviews because the study's design required an in-depth exploration of the novel phenomena (Qu & Dumay, 2011). Semi-structured interviews provide flexibility to researchers and respondents to dig out the critical aspects of the study phenomenon (Troje, 2023). The answers of the interviewees vary depending on perception. The discussions lead to areas not previously considered, although they are significant to the research and provide more flexibility with the interviewees (Gill et al., 2008). Thus, using semi-structured questions, respondents provided valuable insights into workforce management in construction projects (Qu & Dumay, 2011).

There are multiple approaches to conducting interviews, i.e., in-person/ face-to-face, telephonic, online, etc. However, considering the pandemic and the busy schedule of our respondents, two approaches opted for collecting data from respondents, i.e., phone calls and video conferencing using Skype and Zoom (Troje, 2023). Compared with the face-to-face mode, we believe our findings will not be hidden by telephonic/online mode as there is no need for the action’s observation. Contrarily, this option may enable us to get more responses from respondents as people nowadays feel comfortable giving their opinions in their free time using online modes (Novic, 2008; Farooq & De Villiers, 2017). Researchers and respondents in this study stated familiarity and comfort with the two technologies to avoid misunderstandings and other ineffective factors (Farooq & De Villiers, 2017). No problems occurred during the phone calls and video conferencing. So, it acts equivalent to other interview modes in this study.

The initial informants were recruited via the personal contact point of our research team, following purposive sampling (Patton, 2002). After that, we adopted snowball sampling (Punch,

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3 2013). We continuously contacted other potential respondents by referring to the existing  
4 participants. Through that, we can easily collect rich information about the research question and  
5 reach elite informants with trust (Cohen & Arieli, 2011). The interview protocol consisted of  
6 fourteen questions. Part one focused on the respondents' demographics, including their level of  
7 construction experience and the projects they have undertaken. In contrast, the middle part  
8 comprised the main questions regarding the impact of COVID-19 on projects in the construction  
9 industry and workforce management issues. The last part comprised a note of thanks and any  
10 feedback from the respondents or if they wanted to add something more that has yet to be covered.  
11 We encouraged interviewees to have informal discussions and to provide detailed responses  
12 through examples. All interviews were conducted in English, taped after gaining the agreement  
13 from our respondents, and then transcribed and triangulated. Each interview lasted approximately  
14 40 minutes. We stopped conducting interviews after 14 since data saturation had been reached and  
15 no added information had been added (Sumbal et al., 2017). Table 2 summarizes the semi-  
16 structured interview elements and their function.  
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### 34 **Insert Table 2**

### 35 **3.3 Data Analysis**

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38 Inductive data analysis supports the researcher in identifying essential themes and separating them  
39 into broader categories and sub-categories (Eskerod & Ang, 2017). Inductive data exploration  
40 supports identifying essential concepts and patterns and thus facilitates the exploration of  
41 underlying reasoning. Hence, we adopted an extensive iterative data analysis process in two stages,  
42 i.e., pre-analysis and in-depth analysis. The pre-analysis steps adopted in this study involved  
43 recording, transcription, and initial screening of the in-depth interviews with project experts  
44 employed in various construction projects. After pre-analysis, the second stage is an in-depth  
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3 analysis of the interview transcripts. We used thematic analysis to analyze the data (Miles &  
4 Huberman, 1994; Vaismoradi et al., 2013), a systematic process of generating codes and themes,  
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6 and the frequency of their occurrence is used to interpret the results (Creswell, 2013). The data is  
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8 organized and scrutinized for a comprehensive conclusion (Vaismoradi et al., 2013). The study  
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10 followed the six steps of thematic analysis (Braun & Clarke, 2006). The first step, data  
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12 familiarization (Vaismoradi et al., 2013; Miles & Huberman, 1994), includes reading and re-  
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14 reading the data to identify valuable information and structures. The second step is generating  
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16 initial codes, in which we performed line-by-line analysis to label each excerpt with first-order  
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18 code regarding the research question. From the third to fifth steps (searching for themes, reviewing  
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20 themes, defining, and naming themes), we categorized information from broad questions to more  
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22 specific issues. The similar first-order codes are then grouped, labeled, and tabulated for each  
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24 identified category. Each category is well-defined, with internal coherence and external  
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26 distinctiveness. Data analysis was conducted simultaneously with data collection and memo-  
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28 taking to avoid missing inspirations. These approaches generated sixty codes, followed by the  
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30 classification of relevant categories. Table 3 shows examples of codes and themes. The last step is  
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32 reporting. For the credibility of this study, we took several measures. We conducted peer reviews,  
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34 in which we invited other researchers to review our procedures and results, and performed member  
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36 checks, in which the results were validated by our researchers and respondents (Miles &  
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38 Huberman, 1994).  
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### 47 **Insert Table 3**

## 48 **4. Findings**

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51 To answer the research question, the themes generated from the codes were grouped into categories  
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53 shown in Figure 1. The following sections explain these in detail.  
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#### 5 ***4.1 Challenges of Workforce Management in the Construction Industry***

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8 Participant 1 reported, *"From the end of March to the end of June, there was a complete*  
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10 *lockdown in the country, resulting in the cessation of work. In July, work resumed partially, with*  
11 *only critical work being started with a limited number of staff. It took approximately three months*  
12 *after July for the site to be fully operational. The project's progress was significantly low, leading*  
13 *to an extension of the project timeline."*  
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19 Managing the workforce was a significant challenge encountered by the construction industry  
20 during the COVID-19 pandemic. Numerous factors contributed to this difficulty, with most of the  
21 interviewees (100%) reporting a complete cessation of their projects because of the Pandemic.  
22 Subsequently, the resumption of work was phased in, with the easing of lockdowns and the  
23 granting of permission for the construction sector to resume operations. A considerable proportion  
24 of respondents (80%) reported that disruptions hindered the resumed work, negatively impacting  
25 progress. These shutdowns affected the workforce, as they were left without employment and,  
26 subsequently, without a means of income. Participant 2  
27 reported this as:  
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40 *"The construction work was affected during the lockdowns, but upon government approval, the*  
41 *work resumed. However, the work faced difficulties as they had to abide by the government's*  
42 *standard operating procedures (SOPs)."*  
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47 These statements show a significant disruption to construction progress due to the implementation  
48 of lockdown measures and the subsequent adherence to government guidelines.  
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##### 51 ***4.1.1 Supply Chain Issues***

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3 The study participants reported delays in the supply of materials as a significant challenge  
4 faced by the construction industry. This was primarily attributed to the closure of suppliers'  
5 businesses because of the lockdowns imposed to curb the spread of COVID-19. Furthermore,  
6 increased demand for materials after the relaxation of lockdowns also contributed to delays in the  
7 supply chain. Participant 3 stated this:

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14 *"Most of the project materials come from far places. During the lockdown, no supplies from*  
15 *outside the province were allowed. After the lockdown was relaxed, supplies resumed, but delivery*  
16 *was slow because of new SOPs to be followed."*

17  
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21 Additionally, most respondents indicated that construction materials prices had increased because  
22 of the disruptions in the supply chain caused by the Pandemic. A significant increase was reported  
23 in steel, cement, and other concrete materials prices. Some participants also reported additional  
24 costs incurred in construction because of pandemic-related training, new safety measures such as  
25 sanitization and handwashing facilities, and purchasing new protective equipment. Participant 3  
26 explained this:

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35 *"Increasing material prices is the biggest challenge companies have to face. This increase is due*  
36 *to the closure of those facilities and reduced production. The other costs the construction industry*  
37 *must bear now are due to the new COVID-19-related SOPs."*

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42 These results indicate that the impact of the phenomenon under investigation was not confined to  
43 construction companies alone. The participants reported that industries linked to the construction  
44 sector, such as those providing materials or specialized services, were also negatively affected.  
45 Overall, the findings suggest that the phenomenon under investigation had far-reaching  
46 consequences for various stakeholders in the construction industry.

#### 47 48 49 50 51 52 53 **4.1.2 Labor/Employee Retention**

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3 Closure of construction projects and limitations imposed due to the rapid spread of the  
4 infectious virus among workers caused workforce retention issues. Many respondents reported that  
5 during the lockdowns, 80% of the employees were given long leaves, and some workers were also  
6 laid off as construction projects halted due to the Pandemic. After the government approved the  
7 construction sector's reopening, most workers were called back, while others remained on  
8 extended leave or were laid off. The duration of long leave varies among individuals and  
9 departments. According to the respondents, the average duration of extended leave for different  
10 working groups is shown in Table 4:  
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#### 22 **Insert Table 4**

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24 According to a planning engineer, the industry has experienced a significant decline in  
25 work, with a decrease of approximately 40%-50% compared to the previous year. Additionally,  
26 several respondents reported that the industry is currently facing severe financial crises, which  
27 have necessitated the implementation of layoffs and extended leaves to ensure the organization's  
28 survival. Participant 4 described this as:  
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34

35 *"Most workers were sent on long leave when the work slowed because of COVID-19. Nearly all*  
36 *employees were sent home on leave without pay during the lockdown period. Following the restart*  
37 *of work, some were recalled, some remained on long leave, and others were laid off."*  
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#### 42 **4.1.3 Knowledge Management**

43  
44 Managing knowledge within an organization is crucial during pandemics, ensuring that  
45 relevant and accurate information is effectively created and disseminated to employees. Given the  
46 uncertainty and confusion that often arise during these crises, knowledge management is vital for  
47 maintaining cohesion and fostering adaptive responses within the organization. In this context,  
48 effectively managing knowledge is crucial to organizational resilience and success.  
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### ***Ineffective Knowledge Management Processes (Uncertainty)***

During the interviews, a considerable proportion (70%) of the respondents identified uncertainty as the primary challenge in knowledge management. In this context, the respondents highlighted that the prevalent confusion and ambiguity resulted in a need for more clarity on the appropriate methods for transferring and preserving knowledge. Furthermore, the managers responsible for knowledge management have also expressed uncertainty regarding identifying and selecting relevant data because of the ambiguous nature of communication and the absence of clear distinctions between accurate and inaccurate information. Participant 2 described this as:

*"Lack of clear direction is a significant challenge for both employees and managers in the current pandemic regarding knowledge management as the workers do not know what to do, and the managers do not know what data to gather."*

Similarly, Participant 5 highlighted the impact of uncertainty on employee motivation and engagement by stating:

*"If a person is not sure that he has a job tomorrow, then how can you expect knowledge transfer from that person as he is not working with his/her heart?"*

This underscores the importance of clear communication and direction in times of crisis to ensure effective knowledge management.

### ***Inadequate Knowledge Sharing***

The pandemic has imposed significant constraints on knowledge management within the construction industry. Before the pandemic, cost-saving measures had already significantly emphasized limiting resources within the industry. The pandemic further exacerbated this issue, as the closure of construction sites and the shift to remote work resulted in a lack of proper resources and platforms for communication and knowledge sharing. This resulted in a restriction

1  
2  
3 on how knowledge management can be effectively implemented within the construction industry  
4 during the pandemic. This highlights the need for the construction industry to prioritize knowledge  
5 management and allocate necessary resources to ensure its effective implementation. Participant 7  
6 described this as:  
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12 *"Phone calls are the only mode of communication in the construction industry, and it is impossible*  
13 *to transfer knowledge using this mode of communication."*  
14  
15

## 16 17 **4.2 Mitigation Strategies**

### 18 19 **4.2.1 Workforce Management**

20  
21 The COVID-19 pandemic has presented significant challenges for workforce management  
22 in labor-intensive industries, such as construction. Construction work often requires a high degree  
23 of interaction among workers and the simultaneous presence of multiple individuals at a job site.  
24 To address this issue, the construction industry took several steps to mitigate the spread of COVID-  
25 19. Respondents highlighted the following steps taken to protect workers' health and safety while  
26 ensuring that construction projects could continue to progress.  
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#### 35 **a. Health and Safety Measures**

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37 The responses show that various safety measures were implemented to maintain operations  
38 on construction sites during the COVID-19 pandemic. All companies reported the mandatory use  
39 of face masks as a standard measure. Temperature checks at the entrance were also implemented  
40 in most companies. Additionally, large companies have implemented visitor restrictions and social  
41 distancing measures in break areas and at entrances. Conversely, small companies should have  
42 implemented such measures. The availability of hand washing facilities varied among companies,  
43 with larger companies providing a more considerable number of stations than smaller companies.  
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3 Furthermore, it was observed that larger companies adhered to a more considerable number of  
4 standard operating procedures (SOPs) than smaller companies. Participant 5 stated that:  
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6

7 *"To ensure adherence to COVID-19 safety protocols, temperature screenings, mandatory*  
8 *face coverings, and two handwashing stations were implemented at the site."*  
9  
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11  
12 All respondents agreed that the construction industry's current health and safety system is  
13 inadequate. The need for proper measures poses a significant threat to the industry's future  
14 survival. The industry must develop and implement effective health and safety systems to mitigate  
15 potential complications.  
16  
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20  
21 Participant 4 described this as:  
22

23 *"The COVID-19 pandemic has highlighted the deficiencies in the health sector worldwide,*  
24 *and the construction industry is no exception. The lack of a proper health and safety system within*  
25 *the construction industry has been exposed. To ensure survival in the future, a robust health and*  
26 *safety system must be developed within the industry."*  
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33 All the participants concurred that a formal Health, Safety, and Environment (HSE)  
34 department is essential for monitoring and resolving health and safety issues and enforcing  
35 adherence to HSE regulations. Additionally, establishing an HSE department would facilitate the  
36 resolution of environmental problems. However, it was noted that only 30% of the respondents  
37 reported having a formal HSE department in their organizations.  
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45 Participants 1 and 2 explained this issue as follows:  
46

47 *"The current problem pertains to health and a lack of proper health and safety departments*  
48 *in construction organizations. To effectively combat pandemics, all organizations in the industry*  
49 *must establish a dedicated Health, Safety, and Environment (HSE) department to ensure*  
50 *adherence to relevant protocols."*  
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3                   *"Health and safety are the basic needs of the employees, and we do not have this facility in*  
4 *our organization. The absence of such facilities within our organization highlights the need for*  
5 *the mandatory establishment of formal Health, Safety, and Environment (HSE) departments within*  
6 *all organizations as a strategy to address pandemics effectively."*  
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12                   The respondents believed that formulating and implementing standard operating  
13 procedures (SOPs) are crucial in addressing the Pandemic. It is recommended that comprehensive  
14 SOPs be developed for the entire industry and that organizations create SOPs tailored to their  
15 specific circumstances. Participant 8 described this:  
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21                   *"Establishing an HSE department alone is not enough. Developing and strictly enforcing*  
22 *SOPs is essential if we want to survive."*  
23  
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26                   The special SOPs related to the Pandemic are no longer in practice after the gradual  
27 removal of such practices. However, safety and health measures are the fundamental and inevitable  
28 requirements of the construction industry, especially in developing countries where such measures  
29 are vastly neglected.  
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### 34 35                   ***b. Automation*** 36

37                   The construction industry is one of the least automated sectors globally, particularly in  
38 Pakistan, where little effort has been made to integrate technology into the field. According to  
39 respondents, organizations in the industry must learn from the current Pandemic and realize that  
40 manual labor will no longer be a viable option. Incorporating technological advancements is  
41 crucial for the survival and growth of the industry, as it allows for the creation and transfer of  
42 knowledge even after the pandemic era is over. Drucker (2007) supports this viewpoint,  
43 emphasizing the role of technology in propelling the construction industry forward. Most  
44 respondents (70%) acknowledged the need for automation in the industry, as it not only limits the  
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3 spread of pandemics by reducing human contact but also streamlines operations and facilitates  
4 data management. Participant 1 explained this:

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7 *"The construction industry relies heavily on manual labor and has been slow or reluctant to adopt*  
8 *new technologies. There is a pressing need to prioritize the industry's automation on a war footing*  
9 *to survive future pandemics."*

10  
11  
12 The construction industry has seen an increase in automation following the COVID-19 pandemic,  
13 including implementing automatic mixers, batching plants, and concrete and asphalt laying  
14 machines. 20% of the respondents believe that using robots on construction sites would be  
15 beneficial for monitoring the work on site. Additionally, using artificial intelligence in planning  
16 could facilitate more efficient and timely decision-making.

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18  
19 Participants 7 and 4 stated this:

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21  
22 *"We should adopt automation practices similar to those implemented in developed countries to*  
23 *enhance the efficiency of operations. Using robots for monitoring tasks, a technique already*  
24 *prevalent in Europe and America can serve as a starting point. Subsequently, progression towards*  
25 *complete automation can be considered."*

26  
27  
28 *"We should adopt artificial intelligence (AI), as it is imperative for efficient decision-making and*  
29 *speed of operations. Utilizing AI in the planning phase of a startup can greatly aid in the venture's*  
30 *success."*

31  
32  
33 Most respondents also suggested using intelligent applications to gather and transfer information  
34 for construction projects. Participant 7 mentioned that:

35  
36  
37 *"In the current era of advanced technology, integrating smartphone applications within the*  
38 *construction industry is crucial for efficient data collection and communication flow."*

### 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 **c. Multi-sourcing**

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3 The respondents in this study reported that dependency on a single source causes supply  
4 chain issues in the industry. Respondents agreed that the client approval process takes too long, so  
5 contractors stick with one approved source to avoid paying for testing and other requirements for  
6 more than one source. The COVID-19 pandemic further exacerbated this issue, as travel and other  
7 restrictions made it difficult for contractors to secure alternative vendors. This highlights the need  
8 for companies to consider diversifying their supplier base to mitigate the risks of supply  
9 interruption in the event of a disruption to a single supplier. Participants 3 and 1 highlighted this  
10 as:  
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21 *"Our company's procurement of materials primarily relied on a limited number of suppliers*  
22 *located in different regions, such as KPK (province) for cement and Karachi (city) for steel. The*  
23 *imposition of inter-provincial movement restrictions during the Pandemic resulted in significant*  
24 *challenges obtaining these materials."*  
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30 *"The overreliance on single vendors has proven to be detrimental to our operations as the supply*  
31 *of certain products, including cement and sand, was hindered by transportation obstacles, while*  
32 *other supplies were discontinued due to the financial difficulties of the suppliers, leading to factory*  
33 *closures. The company had previously recognized the potential risks associated with this*  
34 *procurement strategy; however, cost considerations overshadowed these concerns. However,*  
35 *considering the recent disruptions, it has become clear that the costs associated with obtaining*  
36 *approvals and utilizing multiple vendors are preferable to the work stoppage and delays caused*  
37 *by inadequate supply by a single vendor. Thus, a reconsideration of our procurement strategy is*  
38 *imperative."*  
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51 Multi-sourcing was the issue most adopted by the construction industry during the Pandemic to  
52 cover the labor shortage in construction sites. The situation after the Pandemic was much better.  
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### 4.3 Knowledge Management

#### *a. Building Awareness*

All participants agreed that construction workers' lack of education and awareness constituted a significant problem in the pandemic scenario. The construction industry is known for being highly labor-intensive, and most workers in this industry need proper education and training. Instead, they rely on skills gained through the traditional "Ustad-Shagird" (mentor-mentee) relationship. The communication surrounding issues related to the pandemic is complicated by the workers' limited knowledge and societal and religious perspectives, which frequently results in an inadequate recognition of the seriousness of the situation. As a result, the workers must adhere to the standard operating procedures (SOPs) established by organizations such as the World Health Organization (WHO), further exacerbating the problem.

Participants 7 and 8 described this:

*"Workers' illiteracy is a major concern, causing many problems. Workers' non-compliance with standard operating procedures (SOPs) is due to their belief that nothing can harm them as it is the will of God."*

*"The most pressing concern is the lack of education. The absence of proper education has resulted in workers needing to comprehend the gravity of the COVID-19 pandemic. Employees must receive adequate education regarding the current threat and the importance of taking necessary precautions."*

It is necessary to arrange training sessions in the construction industry to educate employees on how to react to this crisis. Participants 6 and 3 described it as:

1  
2  
3 *"The industry's current state can be largely attributed to a lack of education among the population.*  
4 *Inadequate knowledge regarding standard operating procedures (SOPs) has resulted in non-*  
5 *compliance and a belief that the situation is a test of God's will."*  
6  
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10 *"The current crisis requires a shift in societal mindset, which can only be achieved through*  
11 *education. To effectively combat this crisis, individuals must be equipped with the necessary*  
12 *knowledge and understanding to adapt to changing circumstances."*  
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17 The consensus among participants was the requirement for training in the current pandemic  
18 scenario. Employee training was crucial for boosting morale and ensuring adherence to standard  
19 guidelines. According to the participants, training sessions were conducted. However, their focus  
20 was limited to safety procedures and following SOPs. The training sessions did not adequately  
21 address the need for effective knowledge transfer to perform tasks through teleconferencing.  
22  
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26 Participant 1 described this as:

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29 *"The implementation of health and safety protocols among office and site workers has been*  
30 *facilitated through a combination of teleconferencing training and on-site demonstrations led by*  
31 *HSE supervisors. These trainings emphasized the importance of social distancing, mask-wearing,*  
32 *and hand hygiene, and were delivered through practical displays to enhance understanding and*  
33 *adherence to these protocols".*  
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#### 42 ***b. Provision of Job Security***

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45 Ensuring job security for employees is a crucial aspect of maximizing their performance  
46 during times of crisis. This is because security and stability enable employees to effectively  
47 transfer their knowledge and skills. Participant 6 stated:

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50 *"During the lockdown period, our company ensured full salary compensation for all employees*  
51 *under government regulations."*  
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3 This assertion finds support in the observation put forth by Participant 5, who emphasized the  
4 importance of peace of mind in facilitating optimal employee performance:  
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8 *"Providing job security for employees is critical for ensuring optimal performance and facilitating*  
9 *effective knowledge management. Confidence in job stability allows individuals to fully invest their*  
10 *expertise and efforts into their work."*  
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15 However, most companies have laid off their employees, and thus, job security has become  
16 a significant obstacle to transferring and utilizing knowledge. Job insecurity hinders employees'  
17 ability to perform effectively and create and translate knowledge into action. Fear of job security  
18 resulted in limited knowledge management activities, affecting task performance. Despite  
19 government-provided relief packages with the construction industry's support, some workers could  
20 not receive the benefits, further exacerbating job security.  
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### 29 ***c. Use of Technology***

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31 The study participants emphasized implementing formal communication systems for  
32 efficient knowledge transfer. Although informal methods, such as WhatsApp groups and phone  
33 calls, were used, the utilization of proper knowledge management systems, incorporating tools  
34 such as content management, project management, and discussion forums, was deemed to be the  
35 optimal approach for knowledge management, as mentioned by Participant 2:  
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43 *"In light of the Pandemic, telephonic and social media communication have become the primary*  
44 *modes of communication, as live interactions are restricted. Developing a system facilitating*  
45 *communication and data transfer would be a valuable knowledge management tool. This system*  
46 *would store all relevant data and allow remote access, facilitating seamless information*  
47 *exchange."*  
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## 54 **5. Discussion and Analysis**

### ***5.1 Centralized warehouses and Improved Supply Chain Network to handle logistics.***

The COVID-19 pandemic significantly impacted global communities, and despite swift responses from governments and companies, much remains to be done (Meng et al., 2021). The construction industry has suffered significant losses, including the closure of construction sites and disruptions to supply chains and operations. The leading cause of work stoppage in the construction industry during the Pandemic has been government decisions (Wang et al., 2022). The shutdown caused a change in project timelines, causing project delays (Gamil & Alhagar, 2020). New SOPs implemented to handle COVID-19 also slowed down the progress of work at sites, and the authorities took more than average time to approve various orders related to the projects. Thus, because of the Pandemic, project delays, shortage of material and labor, and compliance with Corona SOPs increased the cost of the projects (de Oliveira et al., 2023). To mitigate the impact of the Pandemic, construction firms must evaluate the likelihood of delayed material deliveries and ensure the availability of materials, equipment, and labor. The adoption of new procurement procedures, including multi-sourcing locally and internationally and finding new suppliers, is mandatory (Wang et al., 2022). This will ensure a proper value chain to minimize the risks and increase productivity in the future.

### ***5.2 Proper Procedures Implementation for employee well-being in the construction industry is the need of the hour.***

The COVID-19 pandemic has resulted in a significant problem of job loss globally (de Miquel et al., 2022). Millions of workers have been affected, and many small companies have been unable to pay wages during the lockdowns (Khanna, 2020). Employee protection must be prioritized to mitigate the impact of this labor market shock. Three features of the Pandemic have contributed to the shock:

- 1
- 2
- 3 - *Increased unemployment because of shutdowns*
- 4
- 5 - *Worsening employment quality because of a lack of social protection*
- 6
- 7
- 8 - *A disproportionate impact on vulnerable segments of society, such as women and the*
- 9 *elderly*
- 10
- 11

12 To ensure income security for ill workers or those caring for family members during the Pandemic,  
13 paid sick leave must be provided. The employees' mental health is also of prime importance in  
14 these challenging times when a pandemic hits. Top management should frequently interact with  
15 employees and show interest by asking how employees and their families are doing. Such care and  
16 concerns can motivate workers and help them stay well mentally. Two-way communication and a  
17 trustworthy relationship are essential between employees and employers. In that way, the  
18 employees will understand any crisis and stand with the employer (Lertsakornsiri et al., 2022).  
19 Shafi et al. (2020) also back this point that employee consideration, trust, and social relationships  
20 help achieve higher productivity and overcome the crisis. Thus, companies must foster positive  
21 social relationships with employees rather than reducing wages, laying off, and decreasing other  
22 benefits.

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38 Considering the responses revealed by the respondents, we propose the following on-site  
39 measures (Table 5) to manage workforce safety and work effectively (Garai & Ku, 2023) for future  
40 challenges concerning workforce management and knowledge management (Nazeer et al., 2023).  
41 The proposed solutions rely heavily on automation and advanced IT tools. We propose smart  
42 wearables to monitor workers' movement and health, such as oxygen level, blood pressure, heart  
43 rate, etc. Thermal imaging scanners may be developed for easy temperature screening of a group  
44 of individuals (Eyiokur et al., 2022). Laser scanning is a technique used to collect exact data from  
45 construction sites. This data can then calculate the quantity of work to develop a progress report  
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3 for decision-making. GIS-based systems, which are satellite-based, can also check the progress of  
4 a site without visiting it. These new advanced systems can produce a high volume of data that can  
5 improve productivity. Organizations can categorize this data using big data techniques for  
6 decision-making purposes.  
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### 11 **Insert Table 5**

## 12 **6. Conclusion**

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17 The COVID-19 pandemic has had a profound impact on businesses across the globe,  
18 including the construction industry. To assess the effects of the crisis on this sector, the authors  
19 conducted interviews to evaluate the impact and explore strategies for managing the workforce in  
20 post-pandemic circumstances. The results show that numerous factors, such as supply chain issues,  
21 weak healthcare facilities for workers, ineffective knowledge management, and job losses, have  
22 negatively impacted the construction industry. Additionally, the financial effect has been  
23 significant for all stakeholders in the construction industry, leading to widespread layoffs because  
24 of government-imposed lockdowns. Companies implemented Standard Operating Procedures  
25 (SOPs) and took various measures such as wearing masks, implementing social distancing,  
26 providing COVID-19-related safety training, and promoting teleworking. Considering these  
27 findings, various IT-influenced strategies have been proposed to manage the workforce in the  
28 construction industry after COVID-19.  
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### 44 **6.1. Theoretical and Practical Implications**

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47 The findings of this study have several theoretical implications. First, although the existing  
48 literature on the impact and challenges of the pandemic is not scarce, the call for adequate research  
49 on COVID-19's impact on the construction industry still exists (Ahmed et al., 2022). This study  
50 adds up the critical aspects in the literature regarding the impact of the unique phenomena of  
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3 COVID-19 in the construction industry. Second, as the response to the literature review by  
4 Ghansah and Lu (2023) suggested, more research should be conducted in lesser-covered regions;  
5  
6 this study fills the gap in the literature with a particular focus on developing economies concerning  
7  
8 workforce management in the construction sector. Third, implementing the interview methods,  
9  
10 called phone calls and video conferencing, to collect data in this study provides substantial  
11  
12 evidence that the data collected by qualitative telephonic interviews could be feasible and effective  
13  
14 in analyzing to develop a theoretical framework. It could be considered an alternative when face-  
15  
16 to-face interviewing is unavailable, like during the pandemic (Khaled et al., 2024). Fourth, our  
17  
18 study may contribute to the early theoretical framework developing through the theoretical lenses  
19  
20 of dynamic capabilities and knowledge management, i.e., effective workforce management  
21  
22 strategies with knowledge management to combat COVID-19 and future risks caused by similar  
23  
24 dynamic environmental change.  
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31 The study also has several practical implications. First, the results inform construction  
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33 managers, companies, and even the industry about the challenges related to employee management  
34  
35 and risk management strategies, such as implementing a knowledge-sharing process and planning  
36  
37 for current and future crises, such as health issues (Kassem et al., 2023). Construction companies  
38  
39 need centralized warehouses at strategic points to address supply chain issues and combat future  
40  
41 challenges in Pakistan. Second, the findings help identify measures and approaches to effectively  
42  
43 control and mitigate the effects of pandemics in the future and provide a basis for organizations to  
44  
45 develop a precise response plan. Construction companies should ensure proper health care benefits  
46  
47 and pay sick leave for workers during a crisis.  
48  
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51 Third, not only for the construction industry, but our study findings can also benefit other sectors,  
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53 such as the IT industry, as there is a need for specific or tailored workforce management with  
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3 knowledge management systems using state-of-the-art technologies, which can help not only the  
4  
5 construction sector for its future performance (Youssef et al., 2023) but other sectors as well.  
6  
7 Construction companies in developing economies context need to invest in advanced IT tools (both  
8  
9 implemented and trained employees to use these tools) for better workforce management and to  
10  
11 combat post-COVID-19 scenarios. Finally, government organizations can use the findings to  
12  
13 reduce the negative impact of the COVID-19 pandemic on the construction industry and how to  
14  
15 combat such a situation in the future.-Top management in construction companies needs to monitor  
16  
17 employees' mental health. Communication and trust will motivate employees, reduce anxiety, and  
18  
19 increase their productivity post-COVID-19 situations.  
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## 24 **6.2. Limitations and Future Research Directions**

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26 There are some limitations and suggestions for future research agendas in the study. The  
27  
28 study was conducted in the construction industry and specifically in the context of developing  
29  
30 economies, so the results might only be applicable in some contexts. Furthermore, this study  
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32 focuses on developing countries; however, data is collected from only one developing country,  
33  
34 i.e., Pakistan. In this direction, future research to strengthen and validate this study's findings  
35  
36 should focus on other developing countries. The challenges and strategies explored in this study  
37  
38 can be further compared with findings from other developing countries, such as Sri Lanka and  
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40 Maldives (Niroshana et al., 2023). Second, data is collected from respondents using one approach  
41  
42 of interviews under qualitative research design. Future research should focus on other approaches  
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44 to qualitative research design, i.e., focus group discussion. Third, the data has been collected from  
45  
46 a limited sample of top management workers; however, including respondents from all levels can  
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48 further enhance the understanding and development of strategies for workforce management.  
49  
50 Moreover, future research should also focus on quantitative exploration of the phenomena to  
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3 validate this study's findings and develop concrete findings. The findings of this study cover  
4 industrial insights focusing primarily on the stakeholders' perspective and thus provide solid  
5 ground for building future research. The role of government as a critical stakeholder can further  
6 be explored, such as how national-level policies can impact workforce management. Finally, future  
7 studies on efficient workforce management may also consider using disruptive technologies such  
8 as Metaverse and ChatGPT.  
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## Adapting to Change: Redefining Employee Utilization in Construction

### Projects through Lessons Learnt from COVID-19

**Table 1. Interview Statistics**

<b>Participants</b>	<b>Job Title</b>	<b>Age</b>	<b>Experience</b>
1	Site Manager	59	36 Yrs.
2	Lab In charge	46	20 Yrs.
3	Admin Manager	39	15 Yrs.
4	Store Manager	39	15 Yrs.
5	Sr. Manager Finance	39	13 Yrs.
6	Lead Planning Engr.	38	12 Yrs.
7	Senior Engineer (HSE)	35	12 Yrs.
8	Site Engineer	34	11 Yrs.
9	Site Manager	37	15 Yrs.
10	Senior Engineer (HSE)	34	10 Yrs.
11	Project Lead	48	23 Yrs.
12	Senior Planning Engineer	41	15 Yrs.
13	Manager Procurement	35	12 Yrs.
14	Manager Finance	36	11 Yrs.
15	Admin Manager	33	10 Yrs.



**Table 2. Interview Items and Their Purpose**

Purpose	Example Items
What are the demographics and the current situation of construction projects ?	<ul style="list-style-type: none"> <li>• How many employees are there in your company?</li> <li>• How many construction projects are going on at the moment?</li> <li>• What is the current status of your construction projects?</li> </ul>
What is the impact of COVID-19 on projects in construction industry?	<ul style="list-style-type: none"> <li>• How were construction projects affected during COVID-19?</li> <li>• As concern grows over the spread of COVID-19, what is your business doing to address concerns related to projects and mitigate risks?</li> <li>• How can knowledge (of employees and documented) be effectively utilized for construction projects epidemic outbreak? Can you please explain it in the context of your own organization?</li> <li>• What strategies were adopted to handle projects?</li> <li>• What were major challenges for the construction projects during this pandemic?</li> </ul>
What is the impact of COVID-19 on workforce management issues?	<ul style="list-style-type: none"> <li>• How the employees have been managed during COVID-19?</li> <li>• How to manage knowledge-behavior gap during the pandemic?</li> <li>• How was technology incorporated to create and share knowledge to manage the risks of a pandemic outbreak?</li> <li>• How can organizations pull together their best people's knowledge to navigate through a crisis?</li> <li>• How the lessons learnt can help to define better managerial models in order to cope with the pandemic and prepare for the future challenges?</li> </ul>

**Table 3. Codes and Themes**

<b>Codes</b>	<b>Themes</b>
Layoffs	Employee Retention Issue
Financial Issues	
Labor Shortage	
Halted Transportation	Supply chain Issues
Material Shortage	
Increasing Material Cost	
Temperature Checks	Health and safety measures
Social Distancing	
Work from Home	
PPEs/ Hygiene Care	
Communicating COVID-19 SOPs	Building Awareness
Listening to Employees	
Decreasing Anxiety	
Policies	
Feedback	
Interaction with Govt offices/personnel	

**Table 4. Leave Duration**

<b>Role/Designation of Employees</b>	<b>Leave Duration</b>
Site Engineers	3 Months
Quality Control team	3.5 Months
Store team	2.5 Months
Administration officers	4 Months
Craftsmen	3.5 Months
Operators	3 Months
Maintenance Staff	4 Months
Drivers	4 Months
Laborer	3.5 Months

**Table 5.** Recommendations to mitigate COVID-19 Risks in the Construction Industry of Pakistan

Category	Challenges	Recommendations
<b>Workforce Management</b>	<i>Supply Chain Issues</i>	Firms need to have centralized warehouses at strategic points to cope with supply chain issues in future.
	<i>Labor Retention</i>	Recruit labor directly instead of the subcontractors to retain the laborers.
		Equal illness benefits i.e., same rates, be given to all employees including the paid sick leaves. All the employees, regardless of their working status, should be registered with PESSI and EOBI.
		Implementation and development of laws for employees' health care benefits and paid sick leaves.
	Shared pool of skilled workforce be created in order to compensate shortage of employees.	
	<i>Weak Health System</i>	A proper HSE department be established for health and safety of employees. Make tool drop off points to eliminate direct contact among workers in case of future pandemic scenarios. For safety awareness companies can make videos on safety protocols and distribute them among employees.
	<i>Contractors Management</i>	Proper agreements should be made with the subcontractors to handle unforeseen situations or force majeure in future as per lessons learnt from Covid-19 pandemic. 1- Contractors should give necessary safety as well skill enhancement training to the employees. In case of pandemic, contractors should provide training to employees regarding health and safety protocols to combat the situation. 2- Contractors must provide necessary PPEs in case any need arises any future. 3- Logs must be maintained by the contractor regarding training and other measures taken to overcome the pandemic. These can be helpful for future. 4- Contractors should introduce reward policies related to health and safety compliance.
	<i>Technology adoption and Automation of Work</i>	Hardhat mounted headsets be used to communicate with the employees rather than holding long meetings for improved performance.  360° cameras may be used for remotely monitoring the site condition. Drones can also be used for this purpose. A control center be made to manage and operate such systems. This will reduce the workload as well as enhance security and monitoring of the construction projects.  Smart wearables should be used to monitor the health condition of employees for example blood pressure, oxygen rate etc.  Thermal imaging scanners may be developed for easy temperature screening of a group of individuals in case any need arises.

		<p>GIS based systems can also be used to check the progress of a site without visiting.</p> <p>Construction companies should create an environment of trust with workers and help sort out their concerns regarding technology adoption as well as health and security related risks.</p>
<b>Knowledge Management</b>	<i>Ineffective Knowledge Management Processes (Uncertainty)</i>	<p>Trustworthy relationships between employee and employer be built and relevant knowledge should be shared to all employees so that everyone is on the same page.</p> <p>The companies should motivate employees through training or motivational sessions and must retain the employees by taking benefit of the government schemes/incentives of employee retention.</p> <p>A well-planned data collection process be maintained for future planning. A central record be developed for all workers in the industry to provide social security protection to all. Pakistan engineering council (PEC) can do their role and manage the record of all the workers, as most of the organizations are registered to it. On a bigger scale, National database and registration authority (NADRA) can help to manage such record.</p>
	<i>Inadequate Knowledge Sharing</i>	<p>Online portals of construction companies be developed for knowledge sharing activities and resolving queries regarding construction projects as well maintaining necessary documentation for learning and training of employees.</p>

# Adapting to Change: Redefining Employee Utilization in Construction

## Projects through Lessons Learnt from COVID-19

Figure 1. Tree Diagram of Effective Employee Utilization

