

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 economy context and to develop mitigation strategies for post-pandemic workforce management.

Methodology: Using a qualitative research design, we conducted semi-structured interviews with elite informants of various construction firms and analyzed 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: This study contributes to the literature on post-pandemic mitigation strategies, particularly on developing economies and workforce management in the construction industry. The findings also cover industrial insights with a particular emphasis on the stakeholders' perspective and provide a solid foundation for future research.

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.

Further, imposed lockdowns and material and equipment shortages triggered the cancellation and suspension of projects (El Korch, 2022). The suppliers had closed their operations, making in-time delivery of the required material impossible. Other issues include time, cost, and workers' layoffs. Extensive development is evident in the construction industry, especially after the pandemic, such as the adoption of artificial intelligence, the Internet of Things, and tools and concepts of industry 4.0 and 5.0 (Khurshid et al., 2023; Maqbool et al., 2023). The recent technological revolution has also been implemented in the construction industry (Hanifa et al., 2023; Olueye et al., 2023), though mostly evident in developed economies.

Pakistan is a developing economy where the construction industry is pivotal in lowering unemployment and developing an aggregate economy. It creates many employment opportunities because of its linkage with around forty building materials industries. The construction industry employs 7.61% of the workforce (Pakistan Economic Survey, 2019-20). In Pakistan, COVID-19 also wreaked havoc and severely impacted various industries (Waris et al., 2020), including the construction sector. We have found studies on the impact of COVID-19 on the construction industry (e.g., Parr et al., 2020; Hansen, 2020; Assaad & El-Adaway, 2021; Pirzadeh & Lingard, 2021). However, these are primarily focused on developed economies and cover variable aspects such as human travel behavior (Parr et al., 2020), the impact of lockdown on stakeholders from a financial and psychological perspective (Hansen, 2020), viewpoints and review papers to determine best practices and future directions in the construction industry (Assaad & El-Adaway, 2021), the impact of teleworking on the well-being of managers in the construction industry (Pirzadeh & Lingard, 2021) among others.

An important aspect to consider is that COVID-19 had a variable impact on various geographical locations because of numerous factors, such as working environments, culture,

resources, and the severity of the pandemic (Al-Mhdawi et al., 2022). Hence, the role of context is vital, specifically when resource constraints are a big issue in specific contexts, such as developing economies. Moreover, existing studies need to cover a holistic view concerning effective employee utilization at all levels, from laborers to top management, in relation to workforce management through effective knowledge management. The construction sector in Pakistan employs almost 4.7 million workers, and thus, this sector has a higher impact on the country's economy. Thus, in this paper, we aim to examine the following research questions in the context of Pakistan, a developing economy with various resource constraints.

RQ1: What employee utilization challenges were faced by the construction industry during the COVID-19 pandemic in a developing economy context?

RQ2: What strategies could the construction industry adopt for effective employee utilization post-pandemic in a developing economy context?

Through these research questions, we identify the risks brought by external factors to the construction industry and provide various indicators and solutions to enterprises to cater to these risks for effective decision-making. The results could be helpful in the industry to combat post-COVID-19 and future pandemic scenarios by ensuring the safety and productivity of the workers. Our study aims to support practitioners and policymakers in the construction industry by identifying various strategies to avoid such catastrophes in the future.

The paper proceeds with the literature review followed up by the methodology. After the methodology section, next section is findings of the empirical investigation. This section demonstrates challenges in the construction industry and mitigating strategies. It then follows the discussion and analysis. The conclusion and theoretical and practical contributions are presented at the end of the paper.

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).

Developing countries are required to enhance productivity by adopting and implementing technologically advanced methods and processes of construction, which is inevitable for successful construction project delivery (Kissi et al., 2023).

In Pakistan, the government took various steps to combat COVID-19 and provided the required facilities to the people (Batool et al., 2022). The steps included the earliest detection of cases, communication of the risk, social distancing, and quarantines to avoid COVID-19's spread. The government established a COVID-19 relief fund to collect donations for public welfare (Waris et al., 2020). Hospital special units were established to provide 24-hour relief services to COVID-19-affected patients. Many drastic measures taken by the government resulted in the closure of various organizations and the implementation of work from home policy (Batool et al., 2022). Employee retention became a critical issue when the government issued lockdown orders in the country. To oversee this, the labor department of all provinces instructed companies to provide total wages to the employees and not terminate the employees. The construction industry is also affected as most work is fieldwork, and employees must work as teams on construction sites (Oswald et al., 2020).

2.2 COVID-19 - Strategies and Challenges in Construction Sector

COVID-19 severely affected the operations of the construction industry (Brown & Claeys, 2020). Shortage of skilled labor and unavailability of materials because of the lockdown are a few examples of the problems experienced by the construction industry (Gamil & Alhagar, 2020). Most of the construction projects either were suspended or delayed. Similarly, the suppliers involved in the materials' delivery were also affected, and their operations were delayed (El Korch, 2022). The unavailability of construction machinery also turned out to be an enormous problem. Also, construction workers had many positive cases compared to other industries, such as healthcare,

manufacturing, and transportation. Construction workers are also more likely to get hospitalized than in other industries because of on-site risks (Gamil & Alhagar, 2020).

Pamidimukkala and Kermanshachi (2021) mentioned various challenges construction workers face, including psychological, organizational, individual, and economic factors. Further, they mentioned that to manage construction workers' health and safety challenges, it is essential to implement workforce protection, project performance protection, and project continuity. Further, they mentioned that strategies such as social distancing, sanitization of workstations, and effective technology utilization would help in project productivity and keeping the employees safe. Ayat et al. (2021) conducted a systemized review of the literature in the construction sector regarding the effects of the COVID-19 pandemic. Their study revealed that many studies focused on the challenges and impact of COVID-19 on construction sites. Based on this literature review, they further developed recommendations to reduce the impact of the pandemic on the construction sector. These recommendations involve improving the safety guidelines, process improvement, psychological support, and technology adoption. Ogunnusi et al. (2020) reveal that the COVID-19 pandemic caused interruptions in workflow and supply chains, increased anxiety in workers, and new policy implementation issues in the construction sector. Combating these issues involves better procurement planning, virtual working, and social distancing. They also highlighted the importance of technology in combating these issues in the construction sector.

Raoufi and Fayek (2021) surveyed the North American construction industry. They found that it is essential to have regular communication and coordination among project teams and use technology to ensure that the construction projects keep on going. Complying with the health guidelines and implementing standard safety conditions and health monitoring measures is vital. Zamani et al. (2021) argued that the role of the construction industry is significant in the growth

and economic development of the country. They interviewed 20 contractor companies in Malaysia involved in construction projects and found that construction companies faced financial and operational issues. Operational issues were regarding the project timelines, reduced labor, and logistic issues, whereas financial issues pertain to increased project cost, payment issues, and reduced number of projects. They mentioned a few strategies to manage these issues, for example, acquiring complete information regarding the SOPs and other related issues from the Governments and, secondly, looking for grants and funding from the local bodies to support the losses in the businesses.

Ghansah and Lu (2023) conducted a literature review of studies and found that most of the studies focused on the impact of COVID-19 on construction, and fewer studies discussed coping strategies. They categorized the main challenges in existing literature, which are cost and payment-related challenges, work-related challenges, procurement and supply chain-related challenges, site accessibility challenges, and digital technology-related challenges. They then categorized the responding strategies, including governmental policies and instructions and organizational approaches. The organizational approaches involve many practices such as workforce management, risk management, technology adoption, prefabrication construction and lean construction, recycling, and health and safety management techniques. A few post-COVID-19 interventions were also identified, such as implementing a change management model, business continuity strategies, sustainable practices, and changes in design and construction processes, mostly involving technology usage.

3. Methodology

The study aims to investigate the impact of COVID-19 on Pakistan's construction industry and workforce management during the pandemic. In doing so, we adopted a qualitative research design because it is useful when the phenomenon is under-explored, and the research aim is to seek new insights into a specific context (Bruce & Berg, 2001). Therefore, this study adopted a qualitative research design because COVID-19 emerged as a novel phenomenon, and more research is needed, especially from the construction industry's perspective in the context of developing economies.

3.1 Study Participants

Appropriate selection of the respondents is the key to successful qualitative research. Respondents must be the true representatives of the study phenomenon. This study focuses on the construction industry; therefore, participants working on various construction projects were selected carefully. The selection criteria of Sumbal et al. (2017) opted for selecting experts who were elite informants from the construction industry. The main criteria used for the selection of experts were:

- i. They must have over ten years of experience in the construction industry.*
- ii. They are above 30 years of age.*
- iii. They have worked in managerial positions in the construction sector.*
- iv. The chosen respondents worked in different departments of the construction industry and fulfilled the criteria above of an expert. The details of the respondents are provided in Table 1.*

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, two approaches opted for collecting data from respondents, i.e., phone calls and video conferencing using Skype and Zoom (Troje, 2023). Online and telephonic interview options were adopted in this study to get more responses from respondents as people nowadays feel comfortable giving their opinions in their free time using online modes (Novic, 2008; Farooq et al., 2017). The interview protocol consisted of fourteen questions. Part one focused on the respondents' demographics, including their level of construction experience and the projects they have undertaken.

In contrast, the middle part comprised the main questions regarding the impact of COVID-19 on projects in the construction industry and workforce management issues. The last part comprised a note of thanks and any feedback from the respondents or if they wanted to add something more that has yet to be covered. We encouraged interviewees to have informal discussions and to provide detailed responses through examples. All interviews are taped and then transcribed. Each interview lasted approximately 40 minutes. We stopped conducting interviews after 14 since data saturation had been reached and no added information had been added (Sumbal et al., 2017). Table 2 summarizes the semi-structured interview elements and their function.

Insert Table 2

3.3 Data Analysis

Inductive data analysis supports the researcher in identifying essential themes and separating them into broader categories and sub-categories (Eskerod & Ang, 2017). Inductive data exploration supports identifying essential concepts and patterns and thus facilitates the exploration of underlying reasoning. Hence, we adopted an extensive iterative data analysis process in two stages, i.e., pre-analysis and in-depth analysis. The pre-analysis steps adopted in this study involved recording, transcription, and initial screening of the in-depth interviews with project experts employed in various construction projects. After pre-analysis, the second stage is an in-depth analysis of the interview transcripts. We used thematic analysis to analyze the data (Miles & Huberman, 1994; Vaismoradi et al., 2013), a systematic process of generating codes and themes, and the frequency of their occurrence is used to interpret the results (Creswell, 2013). The data is organized and scrutinized for a comprehensive conclusion (Vaismoradi et al., 2013). The first step, data familiarization (Vaismoradi et al., 2013; Miles & Huberman, 1994), includes reading and re-reading the data to identify valuable information and structures. The second phase is data coding, which categorizes information from general questions to more specific issues. The data is then labeled and tabulated for each identified category. These approaches generated sixty codes, followed by the classification of relevant categories. Table 3 shows examples of codes and themes.

Insert Table 3

4. Findings

The themes generated from the codes were grouped into categories shown in Figure 1 to answer the research question. The following sections explain these in detail.

Insert Figure 1

4.1 Challenges of Workforce Management in the Construction Industry

Participant 1 reported, *"From the end of March to the end of June, there was a complete lockdown in the country, resulting in the cessation of work. In July, work resumed partially, with only critical work being started with a limited number of staff. It took approximately three months after July for the site to be fully operational. The project's progress was significantly low, leading to an extension of the project timeline."*

Managing the workforce was a significant challenge encountered by the construction industry during the COVID-19 pandemic. Numerous factors contributed to this difficulty, with most of the interviewees (100%) reporting a complete cessation of their projects because of the Pandemic. Subsequently, the resumption of work was phased in, with the easing of lockdowns and the granting of permission for the construction sector to resume operations. A considerable proportion of respondents (80%) reported that disruptions hindered the resumed work, negatively impacting progress. These shutdowns affected the workforce, as they were left without employment and, subsequently, without a means of income. Participant 2 reported this as:

"The construction work was affected during the lockdowns, but upon government approval, the work resumed. However, the work faced difficulties as they had to abide by the government's standard operating procedures (SOPs)."

These statements show a significant disruption to construction progress due to the implementation of lockdown measures and the subsequent adherence to government guidelines.

4.1.1 Supply Chain Issues

The study participants reported delays in the supply of materials as a significant challenge faced by the construction industry. This was primarily attributed to the closure of suppliers'

businesses because of the lockdowns imposed to curb the spread of COVID-19. Furthermore, increased demand for materials after the relaxation of lockdowns also contributed to delays in the supply chain. Participant 3 stated this:

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

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

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

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

4.1.2 Labor/Employee Retention

Closure of construction projects and limitations imposed due to the rapid spread of the infectious virus among workers caused workforce retention issues. Many respondents reported that

during the lockdowns, 80% of the employees were given long leaves, and some workers were also laid off as construction projects halted due to the Pandemic. After the government approved the construction sector's reopening, most workers were called back, while others remained on extended leave or were laid off. The duration of long leave varied among individuals and departments. According to the respondents, the average duration of long leaves for different working groups is shown in Table 4:

Insert Table 4

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

"Most workers were sent on long leaves when the work slowed because of COVID-19. Nearly all employees were sent home on leave without pay during the lockdown period. Following the restart of work, some were recalled, some remained on long leave, and others were laid off."

4.1.3 Knowledge Management

Managing knowledge within an organization is crucial during pandemics, ensuring that relevant and accurate information is effectively created and disseminated to employees. Given the uncertainty and confusion that often arise during these crises, knowledge management is vital for maintaining cohesion and fostering adaptive responses within the organization. In this context, effectively managing knowledge is crucial to organizational resilience and success.

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

on how knowledge management can be effectively implemented within the construction industry during the pandemic. This highlights the need for the construction industry to prioritize knowledge management and allocate necessary resources to ensure its effective implementation. Participant 7 described this as:

"Phone calls are the only mode of communication in the construction industry, and it is impossible to transfer knowledge using this mode of communication."

4.2 Mitigation Strategies

4.2.1 Workforce Management

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

a. Health and Safety Measures

The responses show that various safety measures were implemented to maintain operations on construction sites during the COVID-19 pandemic. All companies reported the mandatory use of face masks as a standard measure. Temperature checks at the entrance were also implemented in most companies. Additionally, large companies have implemented visitor restrictions and social distancing measures in break areas and at entrances. Conversely, small companies should have implemented such measures. The availability of hand washing facilities varied among companies, with larger companies providing a more considerable number of stations than smaller companies.

Furthermore, it was observed that larger companies adhered to a more considerable number of standard operating procedures (SOPs) than smaller companies. Participant 5 stated that:

"To ensure adherence to COVID-19 safety protocols, temperature screenings, mandatory face coverings, and two handwashing stations were implemented at the site."

All respondents agreed that the construction industry's current health and safety system is inadequate. The need for proper measures poses a significant threat to the industry's future survival. To mitigate potential complications, the industry must develop and implement effective health and safety systems.

Participant 4 described this as:

"The COVID-19 pandemic has highlighted the deficiencies in the health sector worldwide, and the construction industry is no exception. The lack of a proper health and safety system within the construction industry has been exposed. To ensure survival in the future, a robust health and safety system must be developed within the industry."

All the participants concurred that a formal Health, Safety, and Environment (HSE) department is essential for monitoring and resolving health and safety issues and enforcing adherence to HSE regulations. Additionally, establishing an HSE department would facilitate the resolution of environmental problems. However, it was noted that only 30% of the respondents reported having a formal HSE department in their organizations.

Participants 1 and 2 explained this issue as follows:

"The current problem pertains to health and a lack of proper health and safety departments in construction organizations. To effectively combat pandemics, all organizations in the industry must establish a dedicated Health, Safety, and Environment (HSE) department to ensure adherence to relevant protocols."

"Health and safety are the basic needs of the employees, and we do not have this facility in our organization. The absence of such facilities within our organization highlights the need for the mandatory establishment of formal Health, Safety, and Environment (HSE) departments within all organizations as a strategy to address pandemics effectively."

The respondents believed that formulating and implementing standard operating procedures (SOPs) are crucial in addressing the Pandemic. It is recommended that comprehensive SOPs be developed for the entire industry and that organizations create SOPs tailored to their specific circumstances. Participant 8 described this:

"Establishing an HSE department alone is not enough. Developing and strictly enforcing SOPs is essential if we want to survive."

The special SOPs related to the Pandemic are no longer in practice after the gradual removal of such practices. However, safety and health measures are the fundamental and inevitable requirements of the construction industry, especially in developing countries where such measures are vastly neglected.

b. Automation

The construction industry is one of the least automated sectors globally, particularly in Pakistan, where little effort has been made to integrate technology into the field. According to respondents, organizations in the industry must learn from the current Pandemic and realize that manual labor will no longer be a viable option. Incorporating technological advancements is crucial for the survival and growth of the industry, as it allows for the creation and transfer of knowledge even after the pandemic era is over. Drucker (2007) supports this viewpoint, emphasizing the role of technology in propelling the construction industry forward. Most respondents (70%) acknowledged the need for automation in the industry, as it not only limits the

spread of pandemics by reducing human contact but also streamlines operations and facilitates data management. Participant 1 explained this:

"The construction industry relies heavily on manual labor and has been slow or very reluctant to adopt new technologies. There is a pressing need to prioritize the industry's automation on a war footing if we want to survive in future pandemics."

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

Participants 7 and 4 stated this:

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

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

Most of the respondents also suggested the use of intelligent applications to gather and transfer information for construction projects. Participant 7 mentioned that:

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

c. Multi-sourcing

The respondents in this study reported that a dependency on a single source causes supply chain issues in the industry. Respondents agreed that the client approval process takes too long, so contractors stick with one approved source to avoid paying for testing and other requirements for more than one source. The COVID-19 pandemic further exacerbated this issue, as travel and other restrictions made it difficult for contractors to secure alternative vendors. This highlights the need for companies to consider diversifying their supplier base to mitigate the risks of supply interruption in the event of a disruption to a single supplier. Participants 3 and 1 highlighted this as:

"Our company's procurement of materials primarily relied on a limited number of suppliers located in different regions, such as KPK (province) for cement and Karachi (city) for steel. The imposition of inter-provincial movement restrictions during the Pandemic resulted in significant challenges obtaining these materials."

"The overreliance on single vendors has proven to be detrimental to our operations as the supply of certain products, including cement and sand, was hindered by transportation obstacles, while other supplies were discontinued due to the financial difficulties of the suppliers, leading to factory closures. The company had previously recognized the potential risks associated with this procurement strategy; however, cost considerations overshadowed these concerns. However, considering the recent disruptions, it has become clear that the costs associated with obtaining approvals and utilizing multiple vendors are preferable to the work stoppage and delays caused by inadequate supply by a single vendor. Thus, a reconsideration of our procurement strategy is imperative."

Multi-sourcing was the issue most adopted by the construction industry during the Pandemic to cover the labor shortage in construction sites. The situation after the Pandemic was much better.

4.3 Knowledge Management

a. Building Awareness

The All participants agreed that the lack of education and awareness among construction workers 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 limited knowledge and societal and religious perspectives of the workers, 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:

"The industry's current state can be largely attributed to a lack of education among the population. Inadequate knowledge regarding standard operating procedures (SOPs) has resulted in non-compliance and a belief that the situation is a test of God's will."

"The current crisis requires a shift in societal mindset, which can only be achieved through education. To effectively combat this crisis, individuals must be equipped with the necessary knowledge and understanding to adapt to changing circumstances."

The consensus among participants was the requirement for training in the current pandemic scenario. Employee training was crucial for boosting morale and ensuring adherence to standard guidelines. According to the participants, training sessions were conducted. However, their focus was limited to safety procedures and following SOPs. The training sessions did not adequately address the need for effective knowledge transfer to perform tasks through means such as teleconferencing. Participant 1 described this as:

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

b. Provision of Job Security

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

"During the lockdown period, our company ensured full salary compensation for all employees under government regulations."

This assertion finds support in the observation put forth by Participant 5, who emphasized the importance of peace of mind in facilitating optimal employee performance:

"The provision of job security for employees is critical for ensuring optimal performance and facilitating effective knowledge management. Confidence in job stability allows individuals to invest their expertise and efforts into their work fully."

However, most companies have laid off their employees, and thus, job security has become a significant obstacle to transferring and utilizing knowledge. Job insecurity hinders employees' ability to perform effectively and create and translate knowledge into action. Fear of job security resulted in limited knowledge management activities, affecting task performance. Despite government-provided relief packages with the support of the construction industry, some workers could not receive the benefits, further exacerbating job security.

c. Use of Technology

The study participants emphasized implementing formal communication systems for efficient knowledge transfer. Although informal methods, such as WhatsApp groups and phone calls, were used, the utilization of proper knowledge management systems, incorporating tools such as content management, project management, and discussion forums, was deemed to be the optimal approach for knowledge management, as mentioned by Participant 2:

"In light of the Pandemic, telephonic and social media communication have become the primary modes of communication, as live interactions are restricted. Developing a system facilitating communication and data transfer would be a valuable knowledge management tool. This system would store all relevant data and allow remote access, facilitating seamless information exchange."

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. Based on this, we propose that:

P1: *Construction companies in Pakistan need to have centralized warehouses at strategic points to address supply chain issues and combat future challenges.*

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:

- *Increased unemployment because of shutdowns*
- *Worsening employment quality because of a lack of social protection*
- *A disproportionate impact on vulnerable segments of society, such as women and the elderly*

To ensure income security for ill workers or those caring for family members during the Pandemic, paid sick leave must be provided. Hence, we propose that:

P2: *Construction companies should ensure proper health care benefits and paid sick leave for workers during a crisis.*

The employees' mental health is also of prime importance in these challenging times when a pandemic hits. Top management should frequently interact with employees and show interest by asking how employees and their families are doing. Such care and concerns can motivate workers and help them stay well mentally. Two-way communication and a trustworthy relationship are essential between employees and employers. In that way, the employees will understand any crisis and stand with the employer (Lertsakornsiri et al., 2022). Shafi et al. (2020) also back this point that employee consideration, trust, and social relationships help achieve higher productivity and overcome the crisis. Thus, companies must foster positive social relationships with employees rather than going for wage reduction, laying off, and decreasing other benefits. Hence, it is proposed that:

P3: *Top management in construction companies needs to monitor employees' mental health. Communication and trust will motivate employees, reduce anxiety, and increase their productivity post-COVID-19 situations.*

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

P4: *Construction companies in Pakistan need to invest in advanced IT tools (both implemented and trained employees to use these tools) for better workforce management and to combat post-COVID-19 scenarios.*

Insert Table 5

6. Conclusion

The COVID-19 pandemic has had a profound impact on businesses across the globe, including the construction industry. To assess the effects of the crisis on this sector, the authors conducted interviews to evaluate the impact and explore strategies for managing the workforce in

post-pandemic circumstances. The results show that numerous factors, such as supply chain issues, weak healthcare facilities for workers, ineffective knowledge management, and job losses, have negatively impacted the construction industry. Additionally, the financial effect has been significant for all stakeholders in the construction industry, leading to widespread layoffs because of government-imposed lockdowns. Companies implemented Standard Operating Procedures (SOPs) and took various measures such as wearing masks, implementing social distancing, providing COVID-19-related safety training, and promoting teleworking. Considering these findings, various IT-influenced strategies have been proposed to manage the workforce in the construction industry after COVID-19.

7. Theoretical and Practical Implications

The findings of this study have theoretical and practical implications. Theoretically, this study adds up the critical aspects in the literature regarding the impact of the unique phenomena of COVID-19 in the construction industry. This study fills the gap in the literature with a particular focus on developing economies concerning workforce management in the construction sector. The findings of this study cover industrial insights focusing primarily on the stakeholders' perspective and thus provide solid ground for building future research. Practically, the findings can be used by government organizations to reduce the negative impact of the COVID-19 pandemic on the construction industry and how to combat such a situation in the future.

Furthermore, the findings can inform construction companies about risk management strategies and planning for current and future crises, such as health issues. They can also help identify measures and approaches to effectively control and mitigate the effects of pandemics in the future and provide a basis for organizations to develop a precise response plan. The study was conducted in the construction industry and specifically in the context of developing economies, so

the results might only be applicable in some contexts. The data has been collected from a limited sample of top management workers; however, including respondents from all levels can further enhance the understanding and development of strategies for workforce management. The role of government as a critical stakeholder can further be explored, such as how national-level policies can impact workforce management. The use of disruptive technologies such as Metaverse and ChatGPT could also be covered in future studies regarding efficient workforce management.

8. Limitations and Future Research Directions

There are limitations in the study. This study focuses on developing countries; however, data is collected from only one developing country, i.e., Pakistan. In this direction, future research to strengthen and validate this study's findings should focus on other developing countries. Second, data is collected from respondents using one approach of interviews under qualitative research design. Future research should focus on other approaches to qualitative research design, i.e., focus group discussion. Moreover, future research should also focus on quantitative exploration of the phenomena to validate this study's findings and develop concrete findings.

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