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**Effective employee utilization during COVID-19 in
construction industry of Pakistan**

By

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EXECUTIVE SUMMARY

COVID-19 pandemic is the worst of all times. It has drastic effect on the organizations as well as the country as a whole. The construction industry has been affected severely due to this pandemic. This is because it is the most labor intense industry, and the onsite work requires the labor to be onsite. Complete shutdown in the country stopped the operations of the construction industry and causes work delays and labor issues. The main reasons of this were traditional way of working in the industry and lack of technological advancement. Weak health system of the industry is also a big hurdle in continuing the work going safely. This study deals in assessing effective ways for managing workforce during this pandemic. Thematic analysis is done to analyze the data compiled through the interviews done by members of different construction companies. The conclusion was done taking in consideration the data from the literature and the findings of the interviews. The study was concluded with some recommendations from our findings which would be helpful for the organizations to make strategies to effectively manage the workforce in this pandemic and for the future.

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1- INTRODUCTION

It was 2019 when an irresistible virus changed the whole world and created anarchy. It is the major challenge of 21st century (*El-Erien,2020*). The disease was reported firstly in the city of Wuhan, China. Acute respiratory syndrome is the cause of this disease (*Hui et al., 2020*). The virus is infective and spreads quickly across the world and due to which WHO considered it as a pandemic (*WHO, 2020*). As of WHO, up to August 4, 2021, over 200 million people around the globe are infected with the virus, and around 4.25 million lives were lost due to the disease. Pakistan is not exempted from it where the COVID-19 expands its roots steadily. The first of coronavirus cases were confirmed in Pakistan on February 26, 2020, the overall infected cases are 1,047,999 till August 04, 2021; total deaths are 23,575; total patients recovered 945,829, and total cases active are 78,595. The pandemic significantly impacts the economy, society and people's daily life. It has created significant effects till it has spread to the whole world. Nearly every part and every sector of the world have witnessed the destruction of the disease. The economy has faced direct impact of COVID 19 pandemic. The COVID 19 crisis is once-in-a-lifetime systemic shock to the global economy. Most countries have faced recession and decline in the economy. Except medical sector, projects supporting health system and necessary activities like food supplies, all other business activities have been stopped. To minimize the spread of virus, many countries have taken different measures of social distancing, including work from home, travelling ban and lockdowns. Almost all the sectors which are not directly related to health and safety were directed to stop during the lockdown, construction sector is also one of them.

The construction sector has vital role in political, societal and economical development of a country. It has main contribution to GDP of a country's economy. Pakistani construction industry plays an essential part in the development of aggregate economy and lowering unemployment. It generates significant opportunities of employment. The industry by links influences around 40 building materials industries, supporting investments and help in reducing poverty through generation of income opportunities for poor. It gives jobs to around 7.61% of total employed workforce. (Economic Survey 2019-20). The pandemic of COVID 19 has harshly affected the construction industry in various operational aspects. Trained labor shortage and change in working environments are few examples of challenges the construction business has faced. Most of the companies have struggled to manage with the economic impact caused by the pandemic, like market disturbance and decrease in private as well as government investment due to uncertainty.

Material and equipment shortage due to lockdown has stopped all the construction activity triggering cancellation and suspension of projects. This is because most of the businesses of the suppliers have closed and in time delivery of required material was impossible for them. Furthermore, there are numerous other problems caused by lockdown on the industry in terms of resource availability, time, and cost and workers layoff. According to the estimations of International Labor Organization nearly 26 million jobs might be in jeopardy due to COVID 19. This unemployment will affect the labor-intensive industry more than the capital-intensive industry like construction.

1.1 Motivation Behind the Study

Though some initial data on the impact of the COVID 19 on construction industry is available but there is a lot to be known. Industrial insight especially from the stakeholders is missing. Specifically in the context of developing countries like Pakistan there is not much work done on the impact of COVID-19 and how the workforce was managed during this pandemic. There is a lot of gaps in the literature which need to be filled, so to highlight the impact of COVID19 on the construction industry of Pakistan and the workforce management during this pandemic this study was conducted.

1.2 Objective of the Study

The effort focuses on collecting data regarding COVID 19 pandemic's effect on the construction workforce. The work also focuses to identify new opportunities that can be created, and efforts taken to manage COVID 19 pandemic's challenges. The results can be useful by the industry to fight against the pandemic by ensuring the safety and maintaining the productivity. The results can also be useful in the future in case of any pandemic. Our study also aims to support practitioners and policymakers to identify strategies to diminish the impact of Covid-19 on construction industry. Mainly, this study focuses on the risks undertaken by the external factor to the construction industry and help enterprises to predict these risks at earlier stages of decision making and plan effective action accordingly.

2-LITERATURE REVIEW

2.1 Covid -19

When we investigate the pages of the world's history pandemics have always been horrifying killers. The first in records from the west is Athens Plague in 430BC which continued for five years taking the lives of almost 100,000 people in Ethiopia, Libya, Egypt, Sparta and Athens (*www.History.com*, *www.LiveScience.com*). Other known pandemics in the world history are:

- Antonine Plague in Roman Empire taking 5 million lives from of 165 to 180 AD.
- Cyprian Plague, which lasted for 22 years from 250-271 AD, taking lives of 1 million people in Egypt, Rome and Ethiopia to Northern Africa.
- Justinian Plague, in 541-542 AD, taking 50 million lives from western Europe to Middle east.
- Leprosy in Europe which spreads in 11th Century effecting millions of lives.
- History can never overlook the deaths caused by Bambonic Plague in the 14th century for almost 13 years from 1340-1352. Almost 30 million people died during this period in Europe only.
- Viral fever caused by Cocolizti epidemic, taking 15 million deaths in Central America and Mexico from 1545 - 1548.
- Great Marseille Plague of France, causing over one lack deaths from 1720 - 23.
- Russian Plague, having death toll of one lack in Moscow from 1770 - 72.
- Cholera pandemic, 7 attacks of cholera pandemic occurred after every few period of time during 1817 - 1961, in, Germany, Italy, Japan, China, Indonesia, Spain, India, Gulf , Thailand, Philippines, Russia, and Latin America. Causing death of approximately 10, 00,000 people only in Russia and 250,000 in other countries, (Elena, 2020).
- Fiji measles pandemic in 1875, taking 40,000 lives in Australia and Fiji.
- Russian Flu, which spreads from Russia to Europe and beyond, causing 1 million deaths from 1889 – 90.
- Spanish Flu, from 1918 - 20, taking lives of 100 million people worldwide, 675,000 only in US.
- Asian Flu, causing 1.1 million deaths in USA, Singapore, HK, & China, 116,000 in USA from 1957 - 58.
- HIV pandemic, which started from west Africa in 1920 and is still on going. Causing deaths of almost 35 million people.

During the first two decades of 21st century mankind has faced SARS in 2003, Swine-Flu from 2009 to 2010; MERS during 2012, Ebola from 2014 to 2016 & Zika Virus in 2015 as deadly viral diseases. This virus is related to MERS and SARS which emerges from the zoonotic virus (*Guaner, 2020*). Since it is zoonotic, many people attribute their origin to be mammals like bats (*Zhou, 2020*). Several others attribute the COVID-19 outbreak to the sea food markets in China (*Jiang, 2020*). The COVID 19 was firstly treated as pneumonia starting at the end of December 2019 from city of Wuhan in China, and spreads throughout China and then to the whole world. China's Centre for Disease Control (CDC) analyzes the specimens and confirmed novel coronavirus as cause of this pneumonia and named the disease as Novel Coronavirus Pneumonia (NCP) and named the virus as 2019nCoV. Lately it was named as Severe Acute Respiratory Syndrome Coronavirus2 (SARS CoV2) by the International Committee on Taxonomy of Virus, because it causes severe respiratory infection causing pneumonia (*She et al. 2020*). The WHO named the disease as Coronavirus disease 19 (COVID 19) on 11th Feb 2020. According to the data total COVID-19 cases have reached up to 200 million, deaths reported 4.25 million, as of August 04, 202, 02:25. The new cases are increasing quickly, so there is regularly change in the statistics.

2.2 Impact of COVID-19 Globally

The disease has affected the societies and economies globally. There occur lockdowns in the cities throughout the world, restriction on movement of labor, traveling bans, suspension of airlines, and most significantly economic downturn. There are predictions that this pandemic shall have severe complications for the growth of international GDP (*Word Economic, 2020*). Due to this pandemic 3.2% to 5.6% effect on global GDP is expected (ADB, 2020). Furthermore, global FDI (foreign direct investment) is expected to decrease by 20% to 40% due to this pandemic (*UNCTAD, 2020b*). Additionally, the world requires approximately \$8.8 trillion of support package to cover up the loss (*UNCTAD, 2020a*). Thus, on the basis of the figures, this global crisis will be worst as compared to that of 2008 (*UNCTAD, 2020a*). According to ILO COVID-19 has high impact on real estate, hospitality, retail, and moto repairs as compared to health, education, defense, and utilities related sectors (*ILO, 2020b*). COVID-19 will affect developing countries more deeply (*UNCTAD, 2020a*). Countries having weak health infrastructures, depending heavily on tourism and trade sectors, depending on unstable capital flows and deeply indebted are the most vulnerable ones (*World Bank, 2020a*). Economies be revived as the pandemic is controlled but the financial stress will prolong (*World Bank, 2020a*). There are estimations that 11 million people

will go below poverty line (*World Bank, 2020a*). Though there is unpredictable continuing effect of the pandemic on the economy, but it is evident that economic condition of developing countries will be worst before it will get better (*UNCTAD, 2020a*). According to UNDP, income losses will exceed by \$220 billion in developing countries (*UNDP, 2020b*).

2.3 Pakistan and Covid-19

Like other countries COVID-19 spreads in Pakistan gradually. On 26 February 2020 first cases of corona virus were reported in Pakistan. Total of infected cases is 1,047,999 (August 04, 2021, 02:25), the death toll has reached to 23,575; the total recovered cases are 945,829, and the active cases are 78,595.

2.3.1 Demographics

Worldwide, Pakistan is the 5th most populated country: the total population is about 216.6 million. Almost 12% (of the sample size of the survey) of household don't have any cleaning facility for washing purpose i.e., water, soap or any other cleaning agent. About 35% have no separate sanitation facility and only 27% have toilets connected to a septic tanks (*Pakistan Demographic and Health Survey, 2017-18*). Pakistan has around 1280 public hospital, 5527 Basic Health Unit, 690 Rural Health Center, and 5802 dispensaries. The ratio of health facility is: 1 doctor for about 820, 1 dentist per 944 people, and 1 hospital bed per 1620 people. Health facility in urban areas is much better as compared to rural areas (*Economic Survey of Pakistan 2018-19*).

2.3.2 Provincial Update

Corona virus is spreading with an enormous rate in different provinces of Pakistan. Sindh is at the top with 389,699 confirmed COVID-19 cases; total deaths are 6,069, and recovered cases are 333,650. In Punjab, a total 359,321 cases are registered till August 04, 2021; total deaths are 11,104, while the total recovered cases are 333,882. In KPK, the total registered cases are 145,862. The 136,675 cases have recovered, and 4,487 died. The total confirmed cases are 30,749 in Balochistan. Out of which 29,065 are recovered and 328 deaths till date. In Gilgit Baltistan 8,391 are confirmed, 147 deaths, and 7,366 are the recovered cases. Total cases reported in Azad Jammu and Kashmir are 25,301, death cases are 634 death cases and 21,425 have recovered (*WHO, 2021*).

2.3.3 Economic Condition

There are predictions by World Bank that economic performance of South Asian be the worst in 40 years and recession may come in half of the countries (*World Bank, 2020b*). Pakistan

will face the same condition There are warning from the economists that there will come recession with the Lockdown in Pakistan (*Naqvee,2020*). The same predictions are from World Bank as well (*World Bank, 2020b*). Because of the COVID-19 pandemic, real GDP growth rate of Pakistan during FY20 goes to -0.4 due to abrupt slowdown of national and international economic activities, (*Pakistan Bureau of Statistics*). This is because business operations halts with the lockdown, impacting the economy devastatingly. Further, the GDP has recovered in FY21 to 3.94 and there is lot more to come as the virus is still here (*Pakistan Bureau of Statistics*). Even though the GDP growth has improved but the unemployment has increased from 3.98 in 2019-20 to 4.65 in 2020-21 and it is expected to go to 5% till the end of 2021 (*Pakistan Bureau of Statistics*).

2.3.4 Facilitation by Government of Pakistan

Pakistani government has taken all the necessary actions to cope with COVID-19 and give the people essential facilities. After the confirmation of first case in Karachi all the needed actions were taken for the safety of people in the region. The government took obligatory actions to limit the effect of COVID 19. The measures include earliest detection of cases, communication of the risk, social distancing and quarantines to avoid COVID-19's outspread.COVID 19 Relief Fund was established by the government to collect donations for public welfare. Social network helpline in 7 local languages were launched by the government. Lot of hospitals are working to give health relief against COVID-19. Isolation wards were built throughout the country for COVID-19 pandemic at the start to control the pandemic in the country.

A. Monetary Benefit

On 24 March, the government gave monetary relief package of PKR 1.2 trillion for the protection of weak and businesses in the country. It is almost 2% of the GDP. “Ehsaas Emergency Cash Program” is an important part of this relief package in which government plans to give PKR 12,000 as onetime cash grant to 12 million families. Another major part is PKR 200 billion a reserved amount to give relief to daily wage workers harshly affected by country wide lockdown. This includes 6.2 million low-income workers other than 12 million personals already covered in Ehsaas Emergency Cash Program. In “Mazdoor Ka Ehsaas Programme” additional 6.25 million workers will be covered giving relief to daily wagers including drivers, carpenters, welders, painters, construction workers, street vendors, piece-rate workers, cleaning staff, loaders, etc. There are now 18.5 million beneficiaries in Ehsaas program. Other points include allocation of PKR 50 billion to Utility Stores for giving subsidy on food items for the benefit of poor; wheat

procurement targets were enhanced to give cash benefit to rural economy; tax refunds to exporters; Capacity of public hospitals’ was enhanced to deal with the pandemic; reduction in prices of petroleum products and three months instalments of gas and electricity bills.

Economic Relief Package of Pakistan	
Measure	Allotted Amount
Relief for daily wage workers	200 billion
Cash transfers to low-income families	150 billion
Accelerated tax refunds to the export industry	100 billion
Financial support to SMEs	100 billion
Accelerated procurement of wheat	280 billion
Financial support to utility stores	50 billion
Relief in fuel prices	70 billion
Support for health and food supplies	15 billion
Electricity bill payments relief	110 billion
Emergency contingency fund	100 billion
National Disaster Management Authority (NDMA) for the purchase of necessary equipment	25 billion

Table 2.1: Economic Relief Package Pakistan

B. Employee Retention

Employee retention was an issue when government gave lockdown orders in the country. For this purpose, labor department of all provinces gave instructions to employers to give full wages to the employees and not to terminate any contract. Provincial governments have instructed companies to consider the lockdown time as paid leave. The government of KPK announced these days i.e., 6 consecutive weeks as public holiday. The government of Baluchistan give instructions to pay minimum wages i.e., PKR 17,500 to the workers during the lockdown period.

C. Package for Construction Industry

Construction & its related industries were allowed to work after first lockdown even in the later lockdowns. This helped 4.7 million workers of the construction industry as well as other workers of the industries linked to it.

- *Units connected to Naya Pakistan Housing Scheme*

90% tax reimbursement is being given to construction sector connected with Naya Pakistan Housing Scheme.

- *Naya Pakistan Housing Scheme Subsidy*

Naya Pakistan Housing Scheme has been given subsidy of PKR 30 billion.

- *Selling of House*

Anyone selling his house will not have to pay Capital Gain Tax.

- *Tax rate on the Construction Sector*

Construction industry has been taken under fixed-tax regime according to which the tax rate on land will be as per square yard and construction as per square foot.

- *Exemption of withholding tax*

There is no withholding tax on services and materials except the cement and steel as they are organized sectors.

- *Board Formation*

To promote construction industry, it was decided to establish Construction Industry Development Board (CIDB).

- *Sales Tax*

Sales tax on the construction was lowered to 2%.

- *Tax Amnesty Scheme*

There is no inquiry from the investors of the construction industry about the source of wealth they are investing thus they can bring the investment to their tax returns. And in this way, they can regularize their wealth without paying any tax.

D. The SBP Financing Schemes

- *Wages and Salaries payment scheme.*

The main objective of this scheme was that the employees may not be laid off. It gives finance to the business to give salaries to the employees. This scheme covers all businesses and is applicable to all type of employments. With an assurance to retain the employees.

The employer has been given loan on reduced markup of 4-5% and the amount of loan depends on the size of the borrower i.e., 50% to 100% of the expense.

- *Increasing Loan size for SMEs*

The regulatory limit of loan size i.e., PKR 125 million has been increased to PKR 180 million enabling SME's to get more loans.

- *Support for Hospitals and Medical Centers.*

100% financing is being given for the establishment of COVID-19 care facility for hospital or medical center.

2.4 Effect of COVID 19 on Construction Industry

The operational activities of construction industry have been affected severely by COVID-19. Shortage of skilled labor & material due to spread of the disease and lockdowns are few examples of the problems that construction industry is experiencing due to COVID-19. Most of the projects are on halt either they were suspended or delayed. These delays not only effect the sites progress but also the suppliers for the delivery of materials. The availability of machinery has also reduced causing disorder in the industry. According to the survey one fourth of the U.S construction companies have stopped or delayed the projects due to COVID-19. It is evident from the study that the COVID-19 protocols have caused 7% loss on the projects. However, construction workers have been severely affected by the virus, there are lot of positive cases among construction workers. Compared to other industries like healthcare, manufacturing and transportation, construction industry has highest positive cases. Likewise, it is evident from another study that as compared to other industries construction workers have five time more chances to be hospitalized. In Pakistan construction is one of the sectors facing the most economic risk. This sector employees almost 4.7 million workers, who are all at risk due to the lockdowns and social distancing recommendations.

2.5 Impact of Covid 19 on Workers & Employment

The impact of COVID-19 on the labor market is beyond limits. Other than the health and safety issues of the workforces, the economic shock caused by this pandemic has effected the workers in three ways (i) There is reduction in quantity of jobs; (ii) The quality of work i.e. the wages have been reduced and there are risks of getting virus are also there; and (iii) Effect to those who are directly linked to these i.e. families of the workers. Around 25 million people have lost their jobs around the globe (*ILO, 2020c*). The lockdowns have affected 81% of the workers (almost

2.7 billion) around the globe (*ILO, 2020b*). “Since World War it’s the worst global crisis” (*ILO, 2020b*). The unemployment rate has increased rapidly even in the stable economies:

- In Canada here is 5.3% decrease in employment (*Statistics Canada ,2020*).
- There is 5 times increase in unemployment in Norway (*Soolsvik, M.,2020*).
- The unemployment rate has reached up to 12.2% in Austria (*Murphy, F.& King, L.,2020*).
- There is highest increase in unemployment in the history of Israel i.e., 24.1% (*Staf,J., 2020*).
- 800,000 people are unemployed in Spain which is highest in the history (*Badka et al,2020*).

Unemployment claims also tells the same story in different countries. There are 4 million claims of unemployment benefits in France (*Badka et al, 2020*). In Canada, there are 0.5 million unemployment benefit claims (Hagan, S. and Bolongaro,2020). (Approximately 3.2 million people applied for unemployment insurance in U.S. Nearly Due to cancellation of projects and material, equipment shortage 40% of U.S. firms layoff their workers (*Associated General Contractors of America*).Due to the economic slowdown the unemployment in Pakistan, will range from 3-5 million people. There has been short-term unemployment of 10.5 million people because of the lockdowns, this includes daily wagers and contract workers. The job-disruption in the country is to about 21 million workers (*Centre for Labor Research*).

3-METHODOLOGY

3.1 Type of Study

Qualitative study was conducted for this project to observe the impact of covid -19 on the construction industry of Pakistan and workforce management during the pandemic.

3.2 Research Process

Figure 3.1 explains the process adopted for this research.

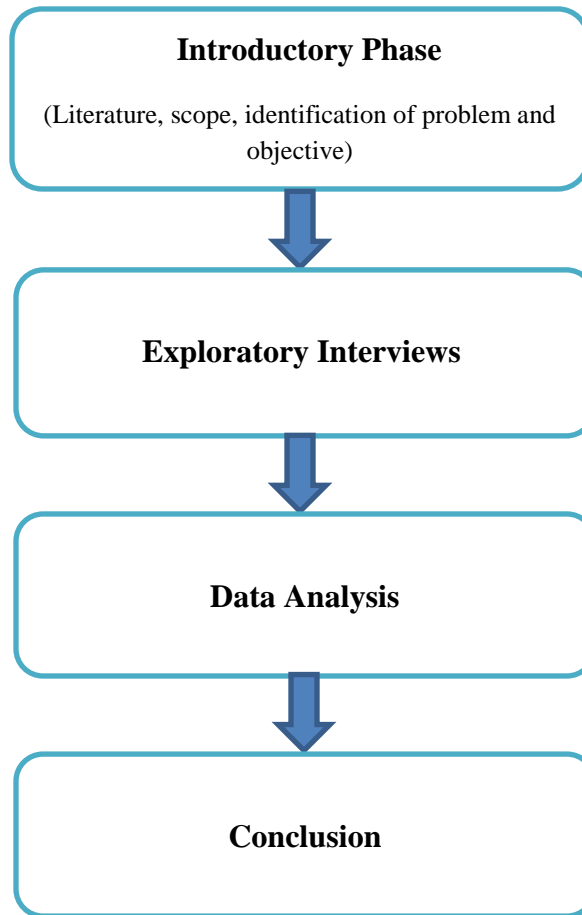


Fig 3.1: Research Process

Two methods were used for data collection in this study.

3.2.1 Introductory Phase

The first phase of the study was the introductory phase. It focuses on the literature to identify and define the objective, problems and scope of the study. What other researchers have done and what literature says about the selected topic.

3.2.2 Exploratory Interviews

The second step was conducting exploratory interviews with experts from the construction sector for their insight and opinion on the current condition of construction industry regarding this pandemic and how workforce was managed during this phase. The interviews were conducted till the saturation of data was occurred, so the total interviews taken in consideration were eight.

A. Interviewee Selection

Study of (*Gamel et al., 2017*), was used for the selection of experts according to which expert is as a person having 10 years of experience in the construction industry and have over 30 years of age and has been given a management role in a construction firm.

B. Interviews

Semi structured interviews were conducted with the experts of construction industry. The semi structured interviews were more suitable because the answers of the interviewees varied depending on perception and the discussions led to areas that not previously considered although they are significant to the research and gave more flexibility with the interviewees. The interviews were conducted remotely using phone call. 14 questions were asked to the interviewees and encouraged to give their response in a free manner during the interviews. The interviews were divided into 3 sections including the social demographics i.e., construction experience and the current project they are working in. The next section is to study the impact of Covid-19 on construction industry. Then, the last section was about the workforce management in construction industry during the Pandemic and how to cater such issues in future. The interviews were about 30 to 40 minutes long.

C. Interviewee Statistics

It was tried to take interviews of the professionals belonging to different departments in the construction industry and also fulfills the criteria of an expert. So that their input and opinion are important to understand the research issue. The job titles and ages and experience of the respondents are as follows:

Participant	Job Title	Age	Experience
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.

Participant	Job Title	Age	Experience
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.

Table 3.1: Interview Statistics

3.2.3 Data Analysis and Interpretation

The method used for data analysis was thematic analysis. This method was used because for the analysis of unknown phenomenon it's a valuable method (Creswel,2013). Themes and the frequency of their occurrence is used to interpret the results. Additionally, the data is organized and scrutinized to get comprehensive conclusion (Turunin et al., 2013). The thematic analysis uses following steps (Amanda & Patrona,2019):

A. Data Familiarization

The first step is data familiarization which includes reading the data many times. This will help in identifying the important information and structuring it.

B. Data Categorization

In this step, coding of data is done by categorizing it to answer the key interview questions. Then the categorization of the facts is done i.e., from general questions to more confined issues. Labeling the data and tabulating of the data is done for each category i.e., codes are generated. In our case almost sixty codes are generated.

C. Themes Formation

In this step, themes are made by clearly studying the data. Themes are generated on the basis of initial codes. During theme formation, the codes are revisited from the second phase and the original data from the first phase. Almost sixty codes were generated which are then summarized into themes. Few examples of the codes and the themes are shown in table 3.2 below

Codes	Themes
Layoffs	Retention
Financial Issues	
Labor Shortage	
Transportation Stoppage	Supply chain Issues
Material Shortage	
Increasing Material Cost	

Codes	Themes
Temperature Check	Health and safety measures
Social Distancing	
Hand Washing	
Communicating COVID-19 SOPs	Building Awareness
Listening to Employees	
Decreasing Anxiety	

Table 3.2: Codes & Themes

D. Results Interpretation

In this phase themes and subthemes are reviewed to ensure the data saturation, the themes are then named, and data is converted into significant findings and complete analysis of issue occurs.

E. Data Presentation

Data presentation is most important step in any study. Good data presentation helps to understand the theme of the study easily. Taking this in mind graphical presentation is used including line charts, bar charts, pie charts etc.

3.2.4 Conclusion

The final phase is to conclude the analysis and give recommendations based on this analysis.

4 – FINDINGS

As mentioned in the previous section that themes were generated from the codes. These themes are placed in each category. This can be seen in the figure 4.1 below:

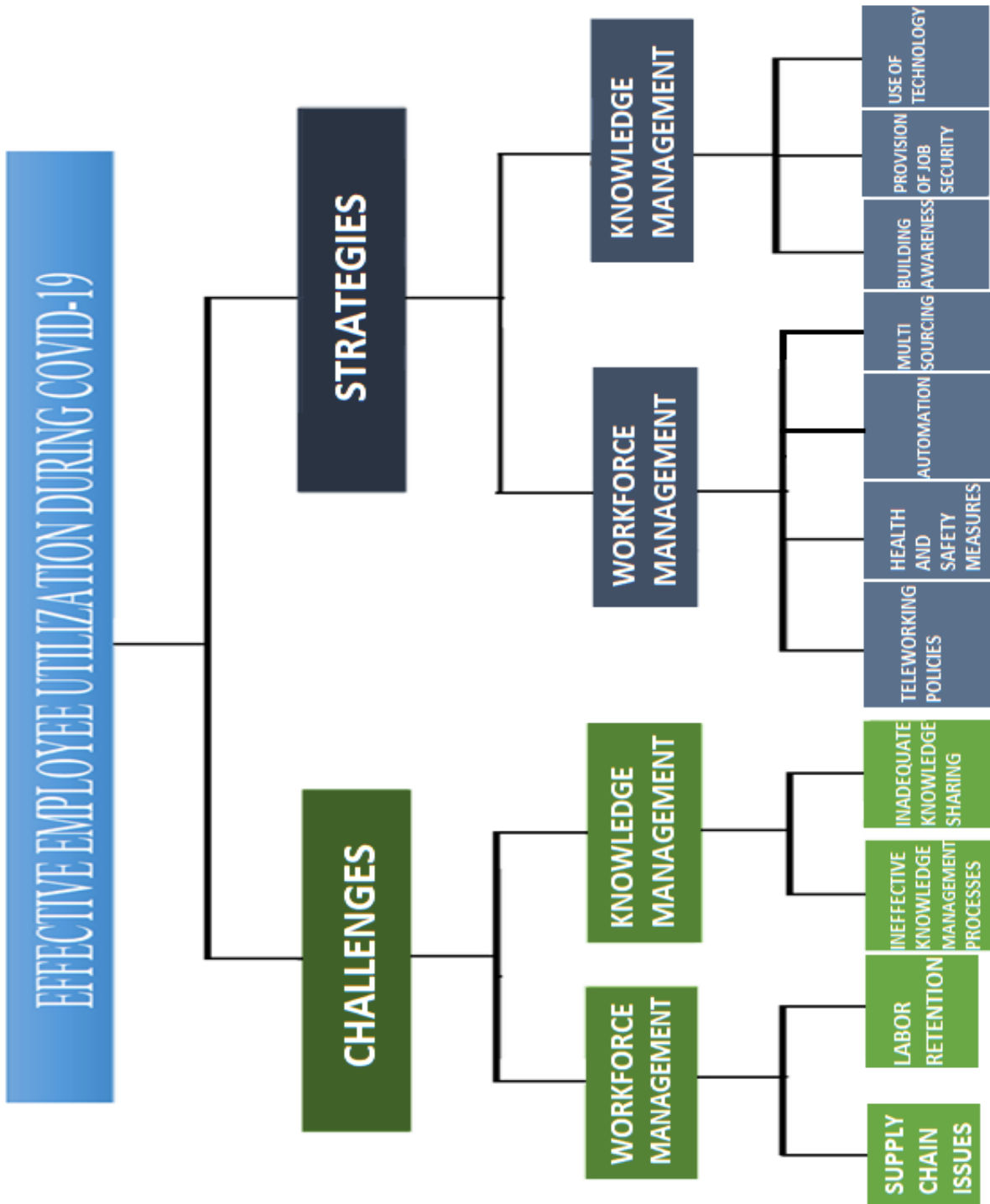


Fig 4.1: Tree Diagram of Employee Utilization

4.1 Challenges Faced During COVID-19

4.1.1 Workforce Management

Workforce management is very critical in such pandemic in the construction industry. There are different factors which causes challenges to manage the work force during COVID-19. Around 100 % of the interviewees there was complete stoppage to their projects due to COVID-19, the work was initially stopped completely then opened in steps. The work was resumed with the ease in the lockdowns and the approval given to construction sector to resume their work. According to 80% of the respondents the work was started with lot of disruption and the progress was affected due to this. Workforce was severely affected due to these shutdowns as they have nothing to work and in return nothing to earn for their living.

“From end of March to the end of June there was complete lockdown in the country due to which the work was stopped. In July the work resumed but partially. Only critical work was started with limited staff. It took almost three months after July to open the site completely. The progress was very low due to which the project was extended”. (Participant 1)

“During lockdowns, construction work was affected. After government’s approval, the work restarted, but it faced few difficulties because they have to follow the government SOPs”. (Participant 2)

The impact was not limited to construction companies. According to the participants the suppliers of the business were also severely affected. Apart from this the industries running with the construction sector have negatively been impacted.

A. Supply chain Issues

There occur delays in the supply of materials. This is due to closure of the suppliers businesses as well and increase in demand after opening of lockdowns. All the participants mentioned this issue.

“Most of the project materials come from far places. During lockdown, no supplies from outside the province were allowed. After the relaxation in the lockdown the supplies resumed but the delivery was slow because of new SOPs to be followed.” (Participant 3)

Most of the respondent indicated that prices of the construction materials increase. This is the impact of increase in costs due to disturbance in the supply chain. Most of the disturbance is due to closure and reduced production due to pandemic. Most of the respondents mentioned the major increase in the prices of steel, cement, and other concrete materials. Some respondents

indicated that extra costs have been added in the construction processes like pandemic related trainings, new safety measures regarding COVID-19 e.g., sanitization, hand washing facility etc. and purchasing new protective equipment.

“The increase in prices of material is the biggest challenge the companies have to face. This increase is due to closure of those facilities and reduced production. The other costs the construction industry has to bear now is due to the new COVID-19 related SOPs”. (Participant3)

B. Labor Retention

Labor impact and job loss were important aspects due to the closure of projects and limitations imposed to gather due to the speedy outspread of the infectious virus amongst workers. Substantial information regarding workforce related challenges was given by the respondents. Many respondents indicated that long leaves were given to most of the workers and some workers are laid off as well when the work decreases on the construction projects. During lockdowns 80% of the employees were given long leaves and after the approval by the government to open construction sector most of the workers were called back while other were on long leave or are laid-off. The duration of long leave varies from individual to individual or department to department. According to respondents the average long leaves duration of different working groups is given below

Work responsibilities	Leave Duration
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 4.1: Leave Duration

According to a planning engineer the work has decreased around 40%-50% in comparison to the last year. Furthermore, some respondents sated that the industry is facing severe financial crises due to which these layoffs and long leaves are necessary to survive.

“Most of the workers are sent on long leaves when the work slowed down due to COVID-19. During the period of lockdown almost all the employees are sent home on leave without pay. After the restart of the work some were called back, some remained on long leave and some were laid off” (Participant 4)

4.1.2 Knowledge Management

During pandemics, management of knowledge in the organization is very important. Such that proper knowledge is created and transferred to the employees in a proper manner. Because there is chaos all around and no one knows what is going to be happened and how to tackle that situation. In such scenario the knowledge management plays a vital role to make everyone intact.

A. Ineffective Knowledge Management Processes (Uncertainty)

According to 70% of the respondents uncertainty was the biggest challenge in managing the knowledge. As there is chaos all around and no one knows what to do and what methods be adopted to transfer the knowledge and how to keep it in this situation as no one knows what is coming next. The managers who are responsible of knowledge management are also uncertain to gather which data and which not because the communication is all ambiguous and there is no discrimination between right and wrong.

“Lack of clear direction is a challenge in this pandemic regarding knowledge management as the workers don't know what they have to do and the managers don't know what data they have to gather.” (Participant 2)

The other issue mentioned by the participant related to uncertainty was that the employees are very much uncertain about their jobs in the future. Due to this uncertain situation, they are not working properly and unable to transfer the knowledge.

“If a person is no sure that he has a job tomorrow then how can you expect knowledge transfer from that person as he is not working with heart.” (Participant 5)

B. Inadequate Knowledge Sharing

Limited resources is also a big restriction in knowledge management during the pandemic. As the construction industry focuses critically on cost saving measures due to which there was not much focus on the knowledge management before the pandemic. To what extent the knowledge management done was restricted by this pandemic as there was either the closure of sites or the office workers are working remotely. There were no proper resources allocated i.e., platforms created for proper communication and knowledge sharing.

“Phone calls are the only mode of communication in construction industry, and it is impossible to transfer knowledge using this mode of communication.” (Participant7)

4.2 Strategies to Face Pandemics

4.2.1 Workforce Management

Workforce management during this pandemic was a big issue especially in labor intense industries like construction. As the interaction among the workers is too much and the working requirement is such that a group of workers have to work at a time. According to the interviews following are the steps taken by the construction industry to tackle this pandemic.

A. Teleworking Policies

Teleworking or work from home is the new normal in COVID-19 pandemic. Most of the sectors have adopted the work from home strategy for the safety of their worker. But in construction industry it's not the case, according to 80% of there is no teleworking strategy in their organizations. And remaining 20% participants responded that there is partial teleworking in their organizations i.e., the office workers who are doing desk-based jobs like planning engineers, cad operators, and other such staff was instructed to work from home during the lockdowns. But after the lockdowns they were called back to offices.

“I don't think our company knows what teleworking is. There is not proper computer-based system than how could you expect teleworking”. (Participant 5)

“Office staff was allowed to work from home for almost 6-8 months at the start. But after that they were called back”. (Participant 6)

According to all the respondents it is very important for the organizations to adopt this new normal as it is important for the survival in this pandemic and such pandemics to come.

“Work from home is a good initiative taken by most of the industries. Construction industry must also adopt this change as it will be helpful to limit the workers from the exposure to the virus as well as it also saves office costs in long run.”(Participant 2)

B. Health and Safety Measures

According to the respondents there were different safety measures adopted to keep work going on sites. Use of face mask was made compulsory. Temperature checks at the entrance were done in most of the companies. In big companies visitors were restricted to come at site and somehow social distancing in break areas and at the entrance were applied. While in small companies there was no such social distancing measures. Hand washing facilities were also

introduced at sites and the number of stations varies from company to company. Big companies give more hand washing facilities as compared to small companies. In the same way the more SOPs were followed by big companies as compared to small companies.

“We have temperature check at the entrance, face covering was compulsory at the site and there are two hand washing stations at our site” (Participant 5).

100% respondents are of the view that health and safety system is very weak. Without initiating health and safety measures it is difficult for the industry to survive in the future. So health and safety system be developed in the construction industry to avoid complications in future.

“This pandemic has exposed the health sector of the world. The construction industry is no exception, it has no proper health and safety system. To survive in the future the health and safety system be well developed.” (Participant 4)

All the participants are of the view that proper formal HSE department be established so that the issue related to health and safety can be monitored and resolved. And employees be bound by HSE department to follow health and safety rules. With HSE department in place the environmental issues can also be resolved. Only 30% respondents have formal HSE department in their organizations.

“The issue we are facing today is related to health, and in maximum organizations in the construction industry there is no proper department for health and safety. If we want to fight with such pandemics today or in future, there must be proper HSE department in all organizations. Which can ensure all the protocols related to health and safety”. (Participant 1)

“Health and safety are the basic needs of the employees, and we don’t have this facility in our organization. The basic strategy to deal with such pandemic is making compulsory for all organizations to have formal HSE department”. (Participant 2)

According to 70% respondents formation and implementation of SOP’s is very important to tackle the pandemic. Some holistic SOPs be made for the whole industry and the organizations also made their SOP’s based upon their scenario but be addition to that of the whole industry. These SOP’s must be implemented as well. SOP’s be made taking in consideration that if any pandemic can come in future, it can be tackled easily.

“Making an HSE department is not enough. SOP’s be made and implemented with force if we want to survive.” (Participant 8)

C. Automation

Construction industry is the least automated industry. In Pakistan there is no work done for the automation of the industry. According to the respondents the organizations have to learn from this pandemic, as the manual work is not much feasible in the future. The technological advancement is must for the survival of the industry and for the creation as well as transfer of the knowledge. Jonnes, (2020) supports this point and stated that technological advancement always moves construction ahead. 70% respondents are of the view that automation is necessary in the industry. As the pandemics are spreading with the human contact the human involvement be lessen. Beside to limit the spread of pandemics it will be helpful in controlling the work. Data creation as well as usage be very easy.

“In construction industry most of the work is done manually. The construction industry is very slow, or you can say it’s very reluctant to adopt new technologies. There is need for the automation of the industry on war footing, if we want to survive in future pandemics”. (Participant 1)

After this pandemic hits there were few upgradations in the construction industry with respect to automation like automatic mixers, automatic batching plants and concrete and asphalt laying machines etc.As of 20% of the respondents there should be use of robots on sites. The work being done by the reports is the next level thing unless we could start with the robots to monitor the work on sites. The artificial intelligence can also be used in the planning process so that the decisions be taken immediately and automatically.

“Like in the developed countries we should also move towards automation. We can use robots for the monitoring of work which is already in use in Europe and America. After that we can move towards the work being done completely done by the robots”. (Participant 7)

“Artificial intelligence is the thing we should adopt now. The decision making automatic and fast. This can all be done with the help of artificial intelligence. It can be used in the planning phase as a startup”. (Participant 4)

50% respondents are of the view that smart applications be used for gathering information and transfer of information. These applications will be helpful to generate and record a lot of data. Communication and usage of the required data be easy on the go. One can get whatever he wants by using such application.

“Today is the time of smart phones and smart apps. The construction industry must use such applications. Which can be helpful in the data collection and flow of information.” (Participant7)

D. Multisourcing

All the respondents are of the view that the industry facing supply chain issues is due to dependency on one source. The main reason told by most of the respondents is that the approval process from the clients is too long that most of the contractors rely on single approved source to avoid huge costs for the approval of multiple sources which includes testing and many other such formalities. During this pandemic the approval process become more complicated due to travel and other such restrictions, and it was not possible for the contractors to carry on the work if they found any alternative vendor. So, this pandemic has rang the alarm that single source is very harmful if such pandemic comes, companies must go for multiple vendors so that the supplies do not stop if something happen to one supplier.

“Our company purchases material from single vendors which were mostly from other provinces i.e. cement comes from KPK, steel comes from Karachi etc. When the lockdowns started it was impossible for us to get cement and steel because there were inter provincial movement bans.”(Participant 3)

“We suffered a lot due to dependency on single vendors. Supplies of some materials like cement and sand were delayed due to transportation issues and some materials were stopped due to shutdown of factories because of financial problems. We have highlighted this issue before the pandemic that the dependency on single vendors is not good but due to cost issues company stayed on single vendors. But now is the time to change because approvals and such costs related to multiple vendors are less as compared to work stoppage and delay due to lack of supply.”(Participant 1)

4.2.2 Knowledge Management

A. Building Awareness

100% of the participants are of the view that illiteracy is the major issue causing lot of problems in the current pandemic. The construction industry is most labor intense industry. Most of the workers lack proper education and are working on the basis of skills developed by ustad shagird relation. It's very difficult to communicate such pandemic issues because they don't have a proper knowledge and don't want to take the pandemic seriously due to lack of knowledge. Due to lack of education people are not understanding the actual threat of COVID-19. They are not willing to obey the SOPs set by WHO or other such organizations.

“Illiteracy of workers are causing lot of problems. The workers are not willing to obey the SOPs as they said it’s the GOD’s will and nothing can harm us” (Participant 7)

“Lack of education is the biggest issue. Due to lack of education workers are not listening regarding threats of COVID-19. Employees be educated regarding the current threat and how much critical it is.”(Participant 8)

Without giving education to the people, it’s very difficult to overcome this crisis and the other crisis of the future. So, the education of the people is must. With respect to construction industry training sessions be established in which the workers be educated what to do in this crisis.

“Lack of education is the biggest cause of the current situation in the industry. People are not obeying the SOPs due to lack of education. And wanted to test the GOD’s will.”(Participant 6)

“People be educated if we want to come out of this crisis because it’s very difficult to overcome the crisis without changing people mind set”. (Participant 3)

All the participants are of the view that the employees be given training regarding current scenario and how to tackle this pandemic. The employees be trained to fight with the pandemic rather than be frightened of it. The moral of the employees be increased, and they must be motivated to take respective actions. They must be trained how to transfer their knowledge effectively in this pandemic. As classroom type trainings are not feasible so other means of trainings be used like through teleconference etc. SO that everyone should know what they have to do in this situation. According to respondents training sessions are conducted but only 70% responded that the training sessions include motivational and knowledge management aspect while others are only related to safety and following the SOP’s.

“The office workers are given trainings through teleconferencing and the site workers at site by HSE supervisors by calling a group of workers and standing them at some distance to each other”. (Participant 1)

B. Provision of Job Security

Job security in the pandemic situations is the biggest barrier in knowledge creation. One cannot perform if he has insecurity regarding his job. Knowledge can only be effectively created and translated into action if one is free of all such thoughts. 40% of the participants are of the view that job retention is biggest factor in knowledge creation. Only one participant responded that they retained their employees. While all other responded that layoffs are done in their organizations. Due to lack of job security there is ineffective knowledge management. Government has offered

relief package for the assistance of the industry during this pandemic. 3 participants indicated that they have received the benefits given by the government while 5 participants have not received these benefits. As about 65% of the participants did not get the government's benefits, this shows that the construction industry is not following government instructions.

“During the lock down period we got complete salaries. This is because our company comply with government orders”. (Participant 6)

Giving employees job security and eliminating their worries regarding their future is the only way to get best out of the employees in this crisis situation. The employees can only transfer their knowledge properly if they are relax and are not worried about anything.

“Employees be given surety about their job if you want their best output, which is essential for effective knowledge management”. (Participant 5)

C. Use of Technology

There was no proper channel for the communication and data transfer during this pandemic. According to 30% of the participants the complete data collection of the current pandemic i.e., what is happening, how this pandemic is affecting what are the measures being taken to mitigate the effect of the pandemic etc. This will help in making a complete strategy for the future, so that if any pandemic comes in future the organization must know how to tackle it. This can be possible if there is a formal platform used for the data transfer. According to the participants there must be a formal system developed for communication and transfer of data. During this pandemic only informal ways like WhatsApp groups and calls are used for data transfer. With the help of this the data be stored, screened and be used by everyone and is the best way to manage the knowledge.

“ During this pandemic the communication is being done on telephones and by social media because live interaction are limited. So, if any system is developed so that the communication is done through it and is also used for data transfer then it will be a best knowledge management tool. As it has all the data stored in it and can be excessed by any one from any where.”(Participant2)

5-ANALYSIS AND DISCUSSION

COVID-19 has a worse effect on global communities, with more than 200 million reported cases as of August 4, 2021 and the numbers are still increasing. Though government and companies around the globe have a quick response but there is much more to do. In these hard times, construction matters more than ever. The industry played an effective role in response to the crisis and in its recovery, by building care units within days. The industry represents 15 percent of global GDP. But the industry has suffered a lot: There has been closure of construction sites. While other sites faced supply chain disruption and restriction to operations. Government decision influences the construction site closures and the consistent impact on the projects. The government's decisions are the main cause of work stoppage in the construction industry amid COVID-19. From the interviews it was clear that there was complete shutdown for almost two months and a lot of interruption due to the pandemic. The industry has faced the limitations in outbound logistic locally due to the lockdowns province wise. Mobilization in construction work site was limited for almost three months causing billions of financial loss to the industry. Construction firms must evaluate the likelihood of stopped or late material deliveries from dealers and make sure availability of materials, equipments and labor. New procedures of procurement are mandatory. Multi sourcing be done locally & internationally, and new suppliers be found.

P1: Firm need to have centralized warehouses at strategic points to cope supply chain issues.

Job losses is also a major problem in this pandemic. Millions of workers around the globe have faced job losses during the COVID-19. A number of workers lost their job and majority of the small companies are unable to pay the wages in lockdown, a significant number of employees join other industries and left the construction industry. This in result in big shortage in of skillful workers in the industry. The Harvard study backs the point of layoff. According to the study of Harvard Business School a lot of small companies were closed temporarily and fired 40% of their workers. (*Bartik et al., 2020*). Employee protection must be the priority. Three features of COVID 19 have made labor market shock: (i) unemployment has increased due to shut down;(ii) employment quality become worse due to no social protection (iii)it has worsen effect on weak portion of society i.e., women and elders, etc. Government has given lot of incentives to the employers to support and retain the employees but all in vain. The government gave direct and indirect payments to the workers through different schemes. But that is not enough. To ensure income security of sick workers during the pandemic or those taking care of family members in

such crisis be given paid sick leaves. In Pakistan the paid sickness leave is only 8 days. For workers register with social security institutes of the provinces, illness benefit is 121 days a year, while registered workers with it are only 1.9 million.

Equal illness benefits i.e. same rates, be given to all employees including the paid sick leaves. All the employees, regardless their working status, should be registered with PESSI and EOBI. Such law be made that if a person is infected by the pandemic be taken as a work injury. Workers who are infected result of their work should be eligible for health care benefits and paid sick leaves or sickness benefit if they are not able to work, as a compensation of suspended earning due to such illness. The members of family who depend on a person who dies of pandemic caused due to work be give monetary assistance. Government should make paid sick leave act as of USA to facilitate the workers. According to which company should give paid sick leave to all employees if they are not able to work due to following reasons:

- i. There are isolation or quarantine orders by the government due to the pandemic.
- ii. There are instructions by health care officials to an employee to self-quarantine due to concerns related to the pandemic.
- iii. The employee has symptoms of disease and looking for medical checkup.
- iv. The employee is taking care of an individual who is advised to isolate by health officials.

There must be a new constitutional amendment to give food, cloths, shelter, education, and medical facility to the citizen who are not able to earn any income due to illness or unemployment. It is the time for such change as we are facing health emergency, and this can be helpful in future crisis as well. The shutdown has caused change in project timelines causing project delays. New SOPs have also slowed down the progress of work at sites. Late approvals from the authorities have also caused change in timeline of the project. The project delays, shortage of material and labor, compliance to corona SOPs have increased the cost of the projects. To survive in future companies must build inventories, identify multiple suppliers, and recruit labor directly instead of the contractors. This will make a proper value chain which minimizes the risks and increase productivity in future. Construction industry has unique characteristics as compared to other industries as it has on site workers and all the staff is required to be present at site either to work or to monitor. Due to this there are no such teleworking policies available on the construction sites. Due to COVID-19 some precautionary measures were taken but because of traditional way of working it caused obstruction in work. There are more chances of the spread of the virus in closed

spaces like offices buildings. So, office staff i.e., planning staff, cad operators should do telework as they don't need to go to site and they have to work by sitting on their desk. Even though by keeping them at site office coordination is easy but it's a big health risk. So, it is proposed that **P2:** Use of technology can help in better workforce management like upgradation of home computers and internet for teleworking.

In the pandemic situation the meetings can also be done with business contacts, workers through zoom, teleconference etc. It is important for implementation of such teleworking policies critical competencies of employees need to be upgraded for such setups and be prepared to adjust in such conditions. Workforce management was a biggest challenge during this Covid-19 pandemic. Workers are either sent on long leaves or remaining are exposed to the virus. COVID 19 has cleared the importance of health and safety of the workers. To keep work going many companies have applied new policies for the health and safety of the workers at project sites like checking the body temperature and handwashing. But those are not enough. Companies must do the needful to mitigate the effect of virus on the workers by taking following measures:

- They must implement social distancing measures by making small teams and increasing the number of shifts.
- Make sure that workers are aware of the situation and know how to protect themselves. Encourage workers to stay at home in case of illness.
- Collect all the employee data like geography etc. and take all the record of the movement of the employees.
- Consider which function can be outsourced to minimize the operational cost.

Most of the people have some idea regarding the importance of personal hygiene to fight against the virus. However, it is important to give more education about COVID-19 to the workers and other operating partners. It is proposed that

P3: Workers hygiene conditions be improved by taking different measures for better workforce as well as knowledge management.

(i)After increasing the handwashing stations at the sites it be ensured the workers must know that they should:

- Wash hands frequently for at least 20 second.
- Use soap or sanitizer for washing the hands.
- Wash hands when they arrive or leave the site, and also before and after the break.

- (ii) As the virus can live for a longer period on the surface, the staff be trained to:
- Daily clean the common areas of the site.
 - Clean common tools after every use and workstations when work ends.
 - Clean offices before and after every shift.
 - Clean the break rooms surface several times.
- (iii) Increase the shifts i.e., half the team works in the day and the remaining in the evening. Divide work in such a way that the workers be decreased in all the locations of the site. This may slow the progress, but it is better than laying off employees.
- (iv) Increase the number of work locations at the site. This will distribute the workers decreasing the number of workers at one place at a time.
- (v) Entry points are the most overcrowding points. So, increase the number of entry points thus decreasing congestion. There must be different arrival and departure timing for each group of workers to eliminate overcrowding.
- (vi) Make tool drop off points to eliminate direct contacts among workers i.e., while passing tools with each other.
- (vii) For outside workers using onsite accommodations create fixed groups so that the contacts remain between same groups.

Team of Researchers from MIT found out that coronavirus carrying drops from sneeze or cough can travel up to 23-27 ft. It is also evident that such droplets are also released while talking and the virus remains active for long time on solid surface i.e., floor, doorknob, and tools. Furthermore, it is also found that the person with virus, but no symptoms can also transmit it. Such factors highlighted that how much important physical distancing among workers is. Companies should implement such physical distancing measures at sites. Find and clear possible choke points and fit barriers and signs for the restricting entrée to close spaces. There should be distant marking at site and break areas. Public food areas and common dispensers be removed from sites. Only single person at a time should use areal lift. Lack of information or misinformation is also a biggest challenge in this pandemic. Companies should not think that the employees know everything about the pandemic. The major challenge these days is false news spreading through social media. For this it's the utmost responsibility of the companies to communicate and post polices regarding pandemic and also share the SOPs. For safety awareness companies can make a video of safety protocols and distribute among employees electronically so that they can see it by themselves.

Companies must be in connection with the employees, client, suppliers and regulators for the free flow of information. For this they must use all available channels like emails, memo, posters, and phone etc. A taskforce be made for effective communication. It be ensured that the information be shared by the companies representative.

In these tough times mental health of the employees be considered. The interactions about their feelings and their families wellbeing shows managements high interest and it will motivate them. In these times of tension, it is very necessary to think about the mental health of workers. The management's interest can be shown by simply asking how they and their families are doing. Such appreciation programs for workers following the SOPs be held, this will motivate them and encourage others to follow SOPs as well. Construction companies should consider worries of the workers about health and safety to mitigate their fears. Onboarding of employees and taking in consideration their concerns help in knowledge management during the pandemic. Companies should lift employees morale by providing support to maintain mental and physical health of employees i.e., by giving supplementary PPE's and counselling opportunity to them. Such actions will motivate them and reduce their anxiety. It is important that two-way communication be encouraged. Companies must consider employees when taking all the decisions. They must encourage the feedback of the employees and they should decrease their fear and must solve their.

During a pandemic, trust is one of the most important factor of success. Any professional setting that promotes trust and unity encourages such policies that shelter employees. If there is trustworthy relationship among employee and employer, then the employees will understand any crisis situation and stands with the employer. When everyone cares for each other than the decisions will be beneficial and acceptable for everyone. It's important to start the process of building such culture from the top. Everyone should be engaged by the leaders for making process effective. The feedback of employees be taken that what are their problems, what they what to do and what will work. By taking everyone on the same page the decisions be taken. During the crisis good employer and employees relationship is considered as an important factor for the success of a firm. Sarker (2020) also back this point that employee consideration, trust and social relationship helps in achieving higher productivity and overcoming the crisis. Thus, rather than going for wage reduction, laying off and decreasing other benefits, companies must foster positive social relationship with the employees. This will give employees job security and thus motivates them to work with full devotion. Though due to corona SOPs in person meetings are discouraged. So new

means of communication like teleconferencing be introduced in the organizations. New modes to communicate remotely be found and implemented.

P4: Safety related measures can help in workforce management during pandemics.

Hardhat mounted headsets be used to communicate with the employees rather than holding long meetings. Communication is now more important for the construction companies than before. Trainings are important for knowledge management. Train the employees regarding corona SOPs and also to be well informed about the current situation and how to be safe and make others safe as well. Job security is the biggest hurdle in knowledge management. The fear of being fired or what will happen next is the main issue the management is facing from the employees in terms of knowledge management. The companies should motivate employees through training or motivational sessions and must retain the employees by taking benefit of the government schemes of employee retention and convince employees that they are with them in the times of the crisis. Training and awareness are important factors to face the pandemic. Conduct trainings of the employees to be resilient. Such trainings be given to enhance employability and future career paths by skills attainment. The employees be encouraged to enhance such skills which open various career opportunities for them instead of fixing to a specific role. They must be given career development opportunities. Give employees multiple roles and tasks so that they can get cross functional training and knowledge. The skill level of workers be improved to adapt the new systems and work effectively rather than making these innovations barrier to the productivity. So, feasible ways like trainings and on the job skill development be used to upskill the workers. Employee education regarding COVID 19 is very important as the employees must know how much dangerous this pandemic is and how to deal with it.

Employees be trained on:

- The symptoms of COVID 19 and the ways the disease can spread and what are the precautionary measures. They should know that person with no symptoms but infected can spread it.
- The protocols to follow to be safe and mitigate the effect of the pandemic.
- Basic hygiene and social distancing Information procedure to follow, like:
 - To avoid physical contact and be 6 ft away from others whenever possible.
 - Wash hands continuously with soap for almost 20 second. Or use hand sanitizers.Clear all the work surfaces regularly.

- Cover the mouth with sleeve during sneeze or cough.
- Not to touch eyes, nose, or mouth with hand.
- Moving individually to the site.
- The use of PPEs and how to handle and dispose them properly.
- To stay at home in case of sickness.
- Wear mask properly covering the mouth and nose to prevent from the virus.
- To report to concerned safety staff in case of any issue.

Preplanning is very important to fight against uncertainties. Thus, the organizations who preplan to fight against pandemics bear less loss, survives, and continue their business. It is clear from the participants response that there was no preplanning to handle such crisis. Almost all the respondents responded that they are not prepared and don't have any planning to cope such a crisis. Thus, it is necessary to aware regarding preplanning's importance to face such a crisis in future. Though the exterior factors are not in ones hand, but precautionary actions and preparedness helps to lessen the loss. So, companies must start preplanning for such crisis in future before it's too late. They must learn from the current crisis and plan accordingly for future. Complete data collection be done during this crisis and plan for future crisis taking in consideration all the things that went right or wrong during this crisis. Labor retention was also the biggest challenge in this pandemic. Which has caused instability in the labor market. Thus, in turn affecting the business as a bounce back. Even there were departmental instructions province wise not to lay off workers and give full wages to the employees during this crisis. But there are only 5.3 million contract workers while about 74% (19 million) workers are working without any contracts or appointment letter in the country. Thus, the orders were ignored and there were layoffs at a large scale. It is important to give all the employees at every proper employment status so that they can get benefit on daily basis and especially in such crisis. Strategy that companies must adopt to overcome this issue is by cooperation. Employees be shared with other companies which are in search of labor. This will help to avoid layoff and job loss. It is clear our finding that 70% of the companies have laid off their employees. So, it is a beneficial technique to avoid layoffs.

P5: Shared pool can help in better workforce as well as knowledge management in construction industry.

Prefabrication is an innovative strategy to face such pandemics. It is very beneficial in a way that the product is made in a separate location with few workers allowing them to be stay safe.

The products are moved to the main site and after fixing them the workers quickly move out of the site. This helps to maintain minimum number of workers at on-site and off-site operations. It is also beneficial for planning and monitoring. The workers can work 24 hours in shifts in a controlled environment. Companies should evaluate which operations can be prefab and should move towards it, as it is beneficial for today and for future in terms of productivity, cost, health and safety. The biggest problem companies facing in this pandemic is due to no proper HSE department in them. There should be proper HSE department for health and safety of employees. A specific person be appointed for inspection, check & balance, and corrective action. Companies should appoint safety officers to implement the proposed SOPs. The site can be monitored physically, by camera or by using drone. Proper formal SOPs be made to counter such pandemic. Controlling peoples entry to the site is very important in such crisis situation. Entry of visitors to the site be minimized and restricted. As much as possible the site be secured with fence and the entry be proper guarded to limit the access to site. There should be proper planning and safety protocols for the deliveries coming to the sites. Such as specific delivery areas, marking the material areas, and using jersey barrier to separate workers from delivery locations.

Clients have the authority to implement strategies to control such crisis in future. Such contracts be made with the contractors so that they be helpful to face any pandemic.

- Contractors should give necessary safety as well skill enhancement trainings to the employees. In case of the pandemic contractor should give training regarding health and safety protocols of that pandemic.
- Contractors have to provide necessary PPEs proposed for the pandemic.
- Logs be maintained by the contractor regarding trainings and other measures taken to overcome the pandemic. These can be helpful for them in future.
- Contractors should introduce reward policies related to health and safety compliance.

False mindset of people is also an issue in this pandemic. There is need to change the mindset of people to overcome this pandemic and that of future. To meet the productivity growth, it is necessary for the construction sector to upgrade operating systems. For the elimination of challenges related to the pandemic new business models and upgraded construction management are needed. Technological advancement like IT based techniques and automation can change the industry significantly as it will change the focus of the industry from traditional to modern enterprise which is today's necessity. One of the noteworthy advancement is using 360° cameras

for remotely capturing site condition. This gives street view tour of the construction sites. The only requirement is of an operator to operate the equipment, and everyone can get actual sites data remotely. This can also be used for monitoring the workforce. AI can be used to monitor PPE at site using these visuals. Drones can also be used for this purpose. A control center be made to manage and operate such system. Organizations who completely depend on paperwork only suffer a lot during this pandemic. Before COVID-19 there were only time delays for the data to be provided from site to the field office but in the crisis, it becomes worse and alarming because it was not possible for them to work remotely due to no online system. This is the perfect time to upgrade the procedures and improve office digital toolbox. By applying real time resource management solutions like cloud-based system for tracking the labor, getting field reports & project trackers can allow office workers to continue work remotely. It is proposed that

P6: Use of technology (Portals) in construction industry could be useful in knowledge sharing activities and resolving issues.

Such software be used in which employees put the photos and videos thus managers can check the progress and get in touch with the workers by answering there queries online. Use of smart wearables are most innovative and useful inventions in the last few years. These devices can also be used at job sites to monitor the movement as well as the health of the workers like oxygen level, blood pressure, heart rate etc. Latest smart bands are helpful for the workers to obey social distancing protocols as these bands alert the workers if they get in close proximity of other. This will help workers to work with full concentration rather than taking care of their surroundings to obey social distancing protocol especially doing critical tasks where little shift in focus is dangerous. In this way by getting alerts workers only have to shift their focus when the get that alert. As temperature check is the main SOP in case of current pandemic, Thermal imaging scanners may be developed for easy temperature screening of a group of individuals. This will help to eliminate long ques during temperature check which is also a violation of social distancing. Laser scanning is a technique to collect exact data of the sites situation using lasers. This data can then be used to calculate the quantity of work and to use progress report for decision making. GIS based systems, which is a satellite-based system can also be used to check the progress of site without visiting it. These new advance systems can produce high volume of data that can be used to improve productivity. This data be categorized using big data techniques for the decision-making purpose.

There is no proper employment record which causes lot of problem to manage and safeguard the workers. So, a central record be developed of all workers in the industry to give social protection to all. PEC can do their role and manage the record of all the workers in the industry as most of the organizations are registered to it. On a bigger scale NADRA can manage such record. Such database be made that the worker who need service can get benefit of this facility. This will evade the resource wastage to give benefit to all. Correct, constant, well-timed, and clear information is vital not only to fight against the pandemics but also to decrease ambiguity and boost the confidence of workers. Lack of accurate information is the biggest challenge the industry has faced during this pandemic. As this cause ambiguity and increase anxiety among employees. Workplace is an important point to spread the information. So, companies should give actual and timely information to the employees which in turn helps in spreading awareness regarding health and safety i.e., how to prevent to decrease spread of the virus. Employees and employers thus can promote the prevention measure in the industry. Proper communication strategies be developed in the organizations so that in case of any crisis employees can get true and timely information.

Another issue that arises was no proper information available at town level. In big cities people somehow know the SOPs and other preventive measures but at town level people are unaware of it. Town hall meetings by the agencies with the contractors is important regarding SOPs and other issues, as some contractors are from rural areas and have no access to latest information. Such meetings will help to resolve contractor's queries. These meetings be held on monthly basis. Communication network be developed in rural areas so that real-time information be reached in the towns timely and effectively. As mentioned before, lack of preplanning is also the biggest issue due to which companies suffer a lot in this pandemic. Companies must redesign their operations learning from the current and previous crisis and plan for such crisis to come. Planning must include financial policies, labor policies etc. Preplanning at every level is vital to decrease the impact and increase resilience thus in turn protects jobs, enterprise, and livelihood.

Summary of recommendations to face the challenges due to COVID-19 in the industry are shown in table 5.1 below:

CATEGORY	CHALLENGES	RECOMENDATION
Workforce Management	Supply chain Issues	Firm need to have centralized warehouses at strategic points to cope supply chain issues.
		Recruit labor directly instead of the sub-contractors.
	Labor Retention	Equal illness benefits i.e. same rates, be given to all employees including the paid sick leaves. All the employees, regardless their working status, should be registered with PESSI and EOBI.
		Such law be made that if a person is infected by the pandemic be taken as a work injury and should be eligible for health care benefits and paid sick leaves.
		Shared pool of skilled workforce be made.
	Weak Health system	Proper HSE department be made for health and safety of employees.
Make tool drop off points to eliminate direct contacts among workers		

<p>Workforce Management</p>	<p>Weak Health system</p>	<p>For safety awareness companies can make a video of safety protocols and distribute among employees.</p>
		<p>Such contracts be made with the contractors so that they be helpful to face any pandemic.</p> <p>1- Contractors should give necessary safety as well skill enhancement trainings to the employees. In case of the pandemic contractor should give training regarding health and safety protocols of that pandemic.</p> <p>2- Contractors must provide necessary PPEs proposed for pandemic.</p> <p>3- Logs be maintained by the contractor regarding trainings and other measures taken to overcome the pandemic. These can be helpful for future.</p> <p>4-Contractors should introduce reward policies related to health and safety compliance.</p>

Workforce Management	Traditional Way of Work	Hardhat mounted headsets be used to communicate with the employees rather than holding long meetings.
		360° cameras be used for remotely capturing site condition. Drones can also be used for this purpose. A control center be made to manage and operate such system.
		Smart wearables be used to monitor health condition of employees.
		Thermal imaging scanners may be developed for easy temperature screening of a group of individuals
		GIS based systems can also be used to check the progress of site without visiting.
		Construction companies should consider worries of the workers about health and safety to mitigate their fears. Onboarding of employees is important.

Knowledge Management	Ineffective Knowledge Management Processes (Uncertainty)	Trustworthy relationship among employee and employer be built.
		The companies should motivate employees through training or motivational sessions and must retain the employees by taking benefit of the government schemes of employee retention
		Complete data collection be done for preplanning for the future. A central record be developed of all workers in the industry to give social protection to all. 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 NADRA can manage such record.
	Inadequate Knowledge Sharing	Portals be developed for knowledge sharing activities and resolving queries.

Table 5.1: Summary of Recommendations

6-CONCLUSION

The COVID 19 has caused considerable disturbances and adversities among businesses as well as whole nations. Similar to other businesses construction industry has also been affected in several ways. By taking interviews this study has explored and evaluated the effects of COVID 19 on the construction industry and how to manage workforce during this crisis. It was found that construction industry has undergone numerous harmful effects. These included material shortage and delay, decreasing efficiency, financial issues, project postponement, price increase, labor impact and job losses. It was also highlighted that financial effect is substantial to all the stakeholders of the construction industry. There were layoffs at large scale due to lockdown imposed by the government. After the sites are opened the companies work hard to lessen the effect by adopting SOPs and limiting number of workers at site. The SOPs include safety measures such as wearing face masks, implementation of social distancing measures, COVID 19 related safety trainings, and promoting teleworking. The findings will be beneficial for the government organizations to minimize the bad effect of COVID-19 faced by the construction industry. Companies can use the findings to find risk management techniques that can be suitable for them and be helpful to plan strategies for current and future crisis. Also, identifying measures and approaches that can be successful and be used to control and lessen the effect of the COVID-19 pandemic and to develop precise response plan that can be used by a broader spectrum of organizations while facing pandemic in future.

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