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CAPTURING THE IMPACT OF COVID-19 ON CONSTRUCTION PROJECTS: A CASE STUDY OF PAKISTAN

Wajid Alim[1], Sabahat Nisar[2] & Rabia Asif[3]

[1]Assistant Professor, Lahore School of Accountancy & Finance, University of Lahore, Pakistan
[2]Deputy Director, Punjab Agriculture Food and Drug Authority, Punjab, Pakistan
[3]Assistant Professor, Lahore College for Women University, Lahore, Pakistan

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ABSTRACT

The spread of COVID-19 has obstructed construction projects worldwide owing to disruptions in supply chain, restriction on the combine work and legislative enforcements. Construction projects from developing economies are more susceptible to these challenges. The aim of this research is to identify factors caused by COVID-19 impacting progress of construction projects and review tools to lessen its negative impact. Multistep methodology is adopted using semi-structured interviews with construction experts to identify factors affected the progress during COVID-19; and data collection from professionals to quantify the significance of each identified factor; Cronbach's alpha for reliability and multiple regression to assess the effect of COVID-19 on progress of construction projects. The findings show that COVID-19 has left severe issues at the operational and financial levels. The remedies use to correct these issues will help policymakers from construction industry to improve existing strategic plans and develop new policies to manage the issues caused by COVID-19.

Corresponding Author: Rabia Asif: rabia_pms@hotmail.com

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INTRODUCTION

The construction industry plays a vital role in economic development of any country (Zamani, Rahman, Fauzi, & Yusof, 2021). The outbreak of pandemic COVID-19 has impacted the social as well as financial structures of world economies. The negative consequences from COVID-19 lead many topmost world economies to the edge of default (Radzi, Rahman, Doh & Esa, 2020). The adverse effect of this pandemic cannot be counted while talking about human cost thus, all needs to work in coordination to defend human as well as economic damages (Gamil & Alhagar, 2020). The spread of COVID-19 affected economy of Pakistan adversely. Due to this, all activities related to the construction are affected and ultimately stopped following preventive restrictions purposed by government. For this industry, virtual work is not practical, as the onsite physical

activity must be conducted. These factors can bring huge negative consequences on economic growth if construction projects got stopped or delayed (Fiaz, 2013; Alenezi, 2020). So, pointing out the factors which impact the construction projects activities during COVID-19 is essential to reduce adverse outcomes from COVID-19 which can ultimately led to economic recession? The measures taken by government have slow down manufacturing activities and halted construction activities.

Further, the flow of financial services is also troubled which created a negative impression on the fiscal as well as the monetary policies. The different steps taken by government to prevent the harmful effects of COVID-19 involve the shifting to virtual education mode, restrictions on inter-city transfer, prohibitions on social meetings, and other interpolations. The noticeable step in this regard, taken up by government is the threshold restriction on the funds allocation to continuing the development projects. Resultantly, the construction projects have been ceased. Further, the COVID-19 left limited space for government to devote more on the development projects due to the diversion of funds to the health sector for meeting COVID-19 challenges (Alenezi, 2020; Radzi, et. al., 2019). These restrictions have caused delays in the completion of construction projects due to cut down in allocated resources. It is then important to investigate that what negative consequences can be arose by the cut down on the expenditures related to the construction activities? The aim of the current paper is to inquire the impact of restrictions imposed by the government during COVID-19 on the progress of construction activities in the Pakistan.

LITERATURE REVIEW

The adverse impact of COVID-19 has been extensively explored keeping in view health, energy, food, agriculture and education sector in last few years. In this regard, Aloui, Goutte, Guesmi & Hchaichi (2020) examined the impact of COVID-19 on energy sector using crude oil and natural gas by applying vector auto-regressive model while, work of Al-Jabir, Kerwan, Nicola, Alsafi, Khan, Sohrabi & Agha (2020) focuses on surgical practice and delivered strategies for efficient and innocuous care for patients. Other have focused their intention to identify the effects of pandemic on food and agricultural sector. Jambor et al. (2020) indicating that labor, supply, food safety, demand and trade are adversely affected during this period. Those who are concerned with the education sector thrown light on the challenges and implied opportunities linked with the pandemic with reference to the adoption of technology in education system (Dawadi, Giri & Simkhada, 2020). Bartik, Bertrand, Cullen, Glaeser, Luca and Stanton (2020), throw light on effect of pandemic on small businesses. Previous studies have examined effect of pandemic on various industries, like changes in traffic behavior due to stoppage of inter-city conveyance (Parr, Wolshon, Renne, Murray & Kim, 2020); or impact on stakeholders due to lockdown (Hansen, 2020), effectiveness of usage of disinfections at work sites, (Kim, Kong, Choi, Han, Baek & Hong, 2021).

Although, these studies have talked about implications of pandemic with respect to developing countries (Wang, Fu, Gao, Shang, Gao, Xing, Ni, Yuan, Qiao & Mi, 2021; Hansen, 2020), still they ignored potential impacts of the COVID-19 that could be viewed at implementation stage of the construction projects. Keeping in view the outcomes form limited sources, the literature review of construction project is distributed into three school of thoughts. In first, the impact of COVID-19 on construction projects is inquired. Then, to address possible outcomes from COVID -19, different strategies taken in the past in the construction industry are discussed. In the end,

the research gap is identified. The delays in the completion of development projects input huge costs into the overall budgeted estimates. When the completion time of development project exceeds the agreed completion time, it is known as construction project delay (Haseeb, Bibi & Rabbani, 2020). The causes of project delays fluctuate according to and due to the faults and weaknesses of execution of policies (Muhammad, Rizwan, Sijun & Libiao, 2013). It is needed to conduct a detailed investigation and identification of factors and their impact on growth of the development projects. It is important to select right course of action to counter these delayed factors within cost and maintaining quality (Arditi, Akan & Gurdamar, 1985; Belassi & Tukel, 1996).

The faults and errors due to the government policies cause delays and waste of capital and time (Rahman & Ayer, 2017). The shortage and incompetent workers and employees are due to the imprecise staff projections. Delay can occur due to the incapability of contractor of the project and properly use the capital (Kabiru & Yahaya, 2020). These are some of the factors that have disturbed the workflow of the development projects. Further, after applying the constructed methodology, we will be able to highlight the important factors that adversely impact growth of development projects during COVID-19. Alenezi (2020) have identifies many reasons of delay in construction projects during this pandemic. He stated that concurrent delay, independent delay, non-excusable delay, and excusable delay as some of the major reasons for failure of the construction projects. Gamil and Alhagar (2020) showed that suspension of construction projects, shortage of the labor force, and overruns of time and cost are most influencing factors by the COVID-19 that impacted overall performance of construction projects. Further while making an attempt to identify the strategies to manage consequences of COVID-19, Luo, Liu, Chen, and Zhang, (2020) have identified challenges faced during design and the construction of hospital project.

They argued that design optimization and information processing among stakeholders are the key strategies which must be clearly executed to avoid outcomes from pandemic. Kabiru and Yahaya (2020) defined that adverse effects of the COVID-19 had significant effects like halting on-site work activities, stopping the bill of quantities, delays in the project completion, causing reduced labor force in construction industry. Since, identification of havoc impacts of COVID-19 is a new research area. Yet many authors have examined the outcomes of the COVID-19 on the construction industry (Harinarain 2020; Parr et al., 2020; Assaad & El-Adaway 2021; Wang et al., 2021). The work of Assaad and El-Adaway (2021) has provided extremely valued strategies and future directions in response to pandemic for construction projects. However, the results of Assaad and El-Adaway (2021) is based on examination of previous findings from literature which did not discourse the inimitable and multifaceted features of the construction projects in developing countries. Keeping in view above discussion, current literature present on construction projects has fall short in identification of comprehensive factors which impacted the progress of construction projects during COVID-19 and no quantitatively assessment on the impact of pandemic on construction projects in developing countries is. This paper fills this knowledge gap.

Theoretical Framework

After the review of related works, the research data was collected from construction projects experts using self-administered questionnaire. The views of construction projects experts were acquired to get related information about factors which impacted the progress of construction-related projects of Pakistan due to COVID-19. After obtaining required information, researcher

identified noticeable factors that are expected to be possible reasons of decline in construction activities during COVID-19. The final list was once again recommended from experts and they have been asked to grade and rank each of given factors with respect to their importance in the progress of construction activities. This all should be done keeping in view ongoing situation spread out by COVID-19. After final grading and scoring of important factors, construction experts have finalized two important factors as follows:

1. Operational factors which may lead to delay in overall project. Experts have identified three sub-factors related to the operation, namely project timeline, availability of labor and material and logistics issues. Due to COVID-19, these three factors were the major reasons that caused the project operation to delay.
2. Secondly, experts have identified financial factors as the second important factor that cause the financial problems during COVID-19. Financial factors include late/delay in payments, increase in project cost, and redemption of released funds of the projects mainly through diversion of funds to health sector.

Figure 1
Theoretical Framework

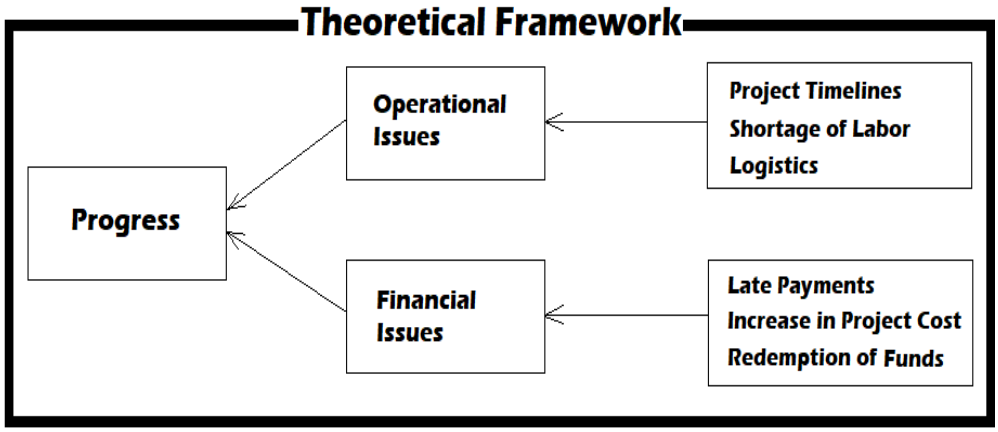

Table 01 defines the results obtained from survey in which critical factors have been identified. Project timeliness is a proposed schedule of work from starting till completion of construction project. During COVID-19, government of Pakistan had adopted the social distancing and work from home policy. The delay in construction project was experienced since construction activities had been stopped and following social distancing, labor was not available due to blockage of inter-city movement that caused the projects to be delayed. Second reason which is expected to delay the project timeline is late approval from authorities. As 50% workers were allowed to join offices during COVID-19, this factor effect approvals for completion of the construction projects. Companies have faced shortage of the skilled labor, mostly those who are migrants from other cities.

Many workers were gone to their native city due to COVID-19 as per government policy. So, lack of availability of skilled labor caused delays in construction works. The delays in the provision of raw material also causes delay in completion of construction projects. This factor explains

material delay issues due to cross-city restrictions and shortens of the supplies due to inter-city movement restrictions. Under financial factor, it is to be noted that project payments are normally paid in series of phases. For public projects, payment is made after the claim of the company condition with completion of the project. So, late and delayed payments by the public offices to continue operational work has added fuel to fire and impacted the progress of construction work. The factors which are expected to increase the project cost, the high price of materials. The high price of the material is a reaction of the changes in foreign exchange and increased demand for supplies.

Table 1
Identification of Determinants of Progress in Construction Activities

SN	Factors	Proxy for	Relation
1.	Project Timelines	Operational Factors	-ve
2.	Shortage of Labor		-ve
3.	Availability of Raw Materials/Logistics		-ve
4.	Late Payments	Financial Factors	-ve
5.	Increase in Project Cost		-ve
6.	Redemption of Released Funds		-ve

During COVID-19, the company were facing problems regarding getting approved funds from government. Because of fact that government has provide some cut-off on total expenditures and limited award of new tenders and competitiveness of contractors. Further, the outbreak of COVID-19 left very limited room for the government to spend more on development projects due to the diversion of funds to the health sector for meeting COVID-19 challenges (Alenezi, 2020; Radzi et al., 2019). The Government allocated Rs. 2,135 billion (Federal Rs. 900 billion and Provincial Rs. 1,235 billon) to Public Sector Development Programs (PSDP) for the year 2021-22, which is 61% higher than previous financial year allocation. Total outlay of the PSDP for the fiscal year 2020-21 was Rs1,324 trillion (Federal PSDP is Rs 650 billion and Provincial PSDP is Rs 674 billion) but utilization during 2021-21 was only Rs. 653.90 million i.e. 49% of the total budget. All these preventions were resulted in lower than the expected revenue and development activities coming to a grinding halt because of the lockdown in the country. This factor impacted the progress of construction activities because cutting down in the resources allocated to development projects directly impact the progress of associated activities. Based on the above discussion the proposed hypothesis of study can be narrated as follows: "COVD-19 has impacted the progress of construction projects in Pakistan at operational and functional level"

RESEARCH METHODOLOGY

The current research is explanatory in nature which seeks to answer the impact of changing dynamics in construction projects due to COVID-19 on progress of construction projects. 300 questionnaires were distributed among construction experts and skilled labor to provide their reviews about the factors that impact progress of public construction projects during COVID-19. These respondents were director or project director or deputy director or manager, or resident engineer, etc. in development projects. A total of 237 responses were received from respondents leaving to response rate of 79% (237/300= 79%). Multiple regression is applied to test study hypothesis.

$$PG = \beta 0 + \beta 1OF + \beta 2FF + €$$

The regression equation is given as above: where, PG stands for the project progress, OF states operational factors and FF explains financial factors that impact the progress of construction industry. In this connection, further, the β0 denotes constant and € represents the error term in equation.

RESULTS OF STUDY

This study is established to ascertain important factors which impact progress of construction activities in Pakistan during COVID-19. In this study, data is analyzed by using SPSS. Cronbach's alpha is applied to test the internal consistency of the applied instrument. In this connection, the results of the reliability analysis of the instrument are given in table-2. It is clear from the results of table-2 that the instrument measures the construct with reliability. Consequently, on basis of reliability analysis, it can be claimed that instrument is reliable and on an acceptable level.

Table 2
Reliability Analysis

Variables Cronbach's Alpha		No. of items
Construction Project Progress	.823	6
Project Timeline	.816	5
Shortage of Labor	.760	3
Logistics	.876	3
Late Payments	.870	6
Increase Project Cost	.826	3
Redemption of released development Budget	.847	4
Overall	0.831	30

Table 3 provides the summary statistics of respondents. It is clear from the obtained summary statistics that the inclusion of male in respondents was equal to almost 80% of the total sample. Rest were the females. This is because females still don't like to work in construction projects in Pakistan.

Table 3
Summary Statistics

Frequency	No.	Valid Percent
Gender:		
Male	127	79.75
Female	48	20.25
Designation:		
Higher Managers	65	27.42
Middle Managers	130	54.85
Lower Managers	42	17.72
Age:		
25-35	80	33.72
36-45	102	43.03
46-60	46	19.40
Above 60	9	3.79

Further, as far as the designation of respondents is concerned, almost 28% of the respondents belongs to higher level management while the proportion of respondents in middle and lower level management stand at 55% and 18%. Taking age of respondents into demographic analysis, it is clear that majority of the respondents (43%) belongs to the 2nd category that falls for 36-5 years of the age while 33% of the respondents were related to 25-35 years of age. Table 4 given below states the descriptive statistics among the study variables. It is clear from the obtained results that progress of the construction projects is negative imposed by the factors arising during COVID-19. The means value of progress lies at 4.35 with SD of 35% stating that majority of the respondents are agree that progress of the projects has been impacted during COVID-19. Further, the mean values of the operational factors lies from 4.12 to 4.72 stating that project timeline, shortage of labor and logistics delays causes a delay in project progress. Similarly, the mean values of the financial factors lie the range from 4.08 to 4.28 stating that less access to funding not only increase the cost of projects but also cause a decline in overall progress of the projects.

Table 4
Descriptive Statistics

	PROG	PT	SL	LO	LP	INC	FUND
Mean	4.35	4.22	4.12	4.71	4.26	4.08	4.28
SD	0.35	0.31	0.26	0.40	0.34	0.26	0.37
Count	237	237	237	237	237	237	237

Table 5 given below states the correlation statistics among study variables. It is clear from the obtained results that all variables have adequately correlated with progress and ultimately each other.

Table 5
Correlation Statistics

	PROG	PT	SL	LO	LP	INC
PROG	1					
PT	0.326	1				
SL	0.299	0.193	1			
LO	0.284	0.234	0.083	1		
LP	0.323	-0.097	0.311	0.190	1	
INC	0.229	-0.108	0.200	-0.047	0.229	1
FUND	0.399	0.158	0.130	0.023	0.016	0.033

Table-6 shows the model summary. The obtained results shows that the value of R-Square is 30.5% which means that explanatory variables explain almost 31% variations in dependent variable.

Table 6
Model Summary

Multiple R	0.552
R Square	0.305
Adjusted R Square	0.287
Standard Error	0.293

Table-7 explains the regression estimates of study variables. It is clear from obtained results that all of selected variables proved to be highly significant instead of redemption of released development budget which is proved to be insignificant. Regarding operational factors, all sub-indicators proved to be significant at 5%. Project timeline is found to be significant at 5% showing that variations in deadlines of project timeline were happened since construction projects have stopped working due to government restrictions on gathering and working from home that caused project delay impacting progress of projects. Further, labor also need to follow SOP's at while working at construction sites which further tend to slow down progress of project. The shortage of labor proved to be significant at 5% showing that Shortage of labor is also observed because most megaprojects are executed in large cities and most of labor comes from small cities or from villages.

Due to slow construction activities labor returned to home towns and got employed in wheat harvesting in their local areas. Closure of trade impact over the import of Mechanical, Electrical and Plumbing (MEP) equipment which causes to halt construction activities. Lockdown is also a highly significant variable. In this connection, lockdown restricts the availability of inputs used on construction activities such as bricks, cement, aggregate, steel bars, crush, electrical, plumbing and sanitary and finishing items, etc. Moreover, lockdown highly disturbs the supply chain of the construction sector. As far as the financial factors are concerned, late payments and increase project costs prove to be significantly associated with progress of the construction projects.

Table 7
Regression Estimates

	Coefficients	SE	t Stat	P-value
C	-0.540	0.523	-1.033	0.303
PT	0.340	0.066	5.141	0.000
SL	0.144	0.080	1.804	0.073
LO	0.143	0.050	2.855	0.005
LP	0.247	0.062	3.985	0.000
INC	0.258	0.078	3.333	0.001
FUND	0.020	0.053	0.388	0.699

Redemption of released development budget creates temporary liquidity crises for the contracts engaged in construction activities. An unexpected increase in dollar value arose the conflict between executing agencies and contractors. In this connection, contractors refused to work on old rates quoted in bids. In this situation, the contractors demanded price escalations or dollar value adjustments from Govt. to avoid heavy losses. Further, labor also need to follow SOP's at while working at construction sites which further tend to slow down progress of the project. In this connection, fluctuation of fuel prices is also one of significant variables. Govt. reduce the fuel prices but oil companies refused to supply fuel at low prices which cause a shortage of fuel at pumps. This shortage impact progress of construction activities. In this connection, during the lockdown, prices of inputs sharply increase. In this regard, mostly affected big cities were closed and the supplier of input in small cities increase the price and charge the price of input arbitrarily.

Table 8
Hypothesis Decision

Variables	Coefficients	Decision
Project Timeline	0.340***	Accepted
Shortage of Labor	0.144**	Accepted
Logistics	0.143***	Accepted
Late Payments	0.247***	Accepted
Increase Project Cost	0.258***	Accepted
Redemption of Released Funds	0.020	Rejected

CONCLUSION

Keeping in view details narrated above, it may be concluded that stress caused by COVID-19 in the global economy can be translated into the local economy in terms of variations in exchange rates, interest rates, and fuel prices. These factors further increased the local cost of production leading to slowdown of construction activities. Further, shortage of labor due to maintenance of social distancing and the ban on inter-city transport added fuel to fire in terms of labor and raw material availability impacting the progress of construction activities. This study explains outcomes of impact of changing dynamics impacted by COVID-19 on progress of construction projects. For this, questionnaire survey has been taken from construction experts about their idea on the progress of construction projects during COVID-19. The results of the study show that COVID-19 has adversely impact the progress of public sector development projects by impacting their operational and functional attributes. The present research contributes to the body of the existing literature by providing an overview about the time and cost delays in the construction projects during COVID-19 not previously explored. This study also contributes to the theory of public projects management by suggesting the recommendations adopting which progress of public sector construction projects can be speed up and completed avoiding much delays.

Recommendations

Based on the obtained results, it can be recommended that government should try to continue infrastructure-related activities especially construction activities by allowing labor to strictly comply with SoP's with proper check and balance through district level management. Also, the executives of the construction activities can facilitate the labor by providing them healthy food, proper vaccination, and a controlled working environment to safeguard the interests of both employer and employee. During COVID-19 Government announced attractive construction package to coop up financial issues of registered construction firms which assist to manage budgetary needs and cash flow requirements. Government should ensure to deal with iron hands with ghost construction companies established for seeking temporary benefits from government construction package.

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