

IMPACT OF COVID-19 ON CONSTRUCTION PROJECT: A CASE STUDY ON THE CONSTRUCTION OF MECHANICAL ENGINEERING BLOCK AT JNEC

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Abstract – This paper presents the case study on the construction project of mechanical engineering block at Jigme Namgyel Engineering College. Due to the current pandemic, it is observed that a large number of construction projects were affected in many ways. This paper has attempted to study the impact of COVID-19 on the construction project specifically on material and labor supply. While undertaking the study the data were collected using mixed method that is qualitative and quantitative research approaches. The study considered two broad areas of material and labor supply and also includes other smaller areas. The study could determine total of 20 factors related to materials and labor supply out of which only 10 factors having a high relative importance index are selected as the major factor affected by the COVID-19 on the identified construction sector.

Keywords: *Construction Project, COVID-19, Material Supply, Labor*

Introduction

The construction industry is the vital component for economic sector that plays a crucial role in the social and economic development of the country. Creation of job opportunities, expansion of investment options, and improvement in the country's national revenue are the prime contribution of the construction industries to the national economy. However, on 11th March 2020, the World Health Organization (WHO) proclaimed the Coronavirus (COVID-19) as a pandemic [1], indicating the disease's global expansion and is facing regulatory challenges and risks in all industries, including the construction industry due to the spread of COVID-19.

Since 14th March 2020, the impact of pandemic is severely felt in Bhutan as many construction projects has also affected. The coronavirus has created a fall in the productivity or output of the construction sector causing the further shrinking of the overall economic activity of Bhutan.

Considering the impact of COVID-19 in the construction sector the study has choose the construction of mechanical

Engineering block at JNEC as case study. The construction project of Mechanical Engineering Block awarded to M/s Pema Junay Construction Private Limited with the allocated budget of Nu 60.979 million funded by the Government of India. The project commenced on 21st April 2020 amid COVID-19 and it is suppose to be completed on 22nd April 2022 over the span of 22 months. Thus, the construction of mechanical block has to comply with the government regulations and travel restrictions as well as manage the supply chain interruption and delay in execution due to outbreak of COVID-19. This study concentrates on the effect of the COVID-19 on the construction workforce, material supply, and overall impact of COVID-19 on construction activity.

The study aspects to identify some of the major impact of COVID-19 on material and labor supply of the identified construction project. In addition, the study also aspects to look into other areas and provide recommendation that might be beneficial for the identified construction project.

Literature Review

The COVID 19 has impacted the construction industry in a variety of ways, including loss of labor, lack of supplies, increased cost of construction material, and the change in demand [2]. It is hard to complete most of the construction projects in time as per the set contracts .

Likewise, the COVID-19 pandemic has also negatively impacted the supply chain of materials of the construction project [3]. The efficient management of materials is critical to the successful completion of a project. Material control is an extremely important and vital subject for any company, and it must be handled effectively for a project to be completed successfully. A well-managed materials management system can contribute to the cost-effectiveness of a project [4] . An effective material management system can bring many benefits for a company. Previous studies carried by the Construction Industry Institute (CII) concluded that Labor productivity could be improved by six percent and can produce 4-6% additional savings [5]. However, the current pandemic has caused many negative impacts on materials such as; delays in supply of

materials, unavailability of materials, not getting the right quality and quantity of materials for the project.

Methodology

This study has used mix method, qualitative and quantitative approaches for collecting data. A total of 25 respondent were involved in construction project were provided survey questionnaires. For the purpose of qualitative data, structured interview was conducted with 8 selected members from the construction project

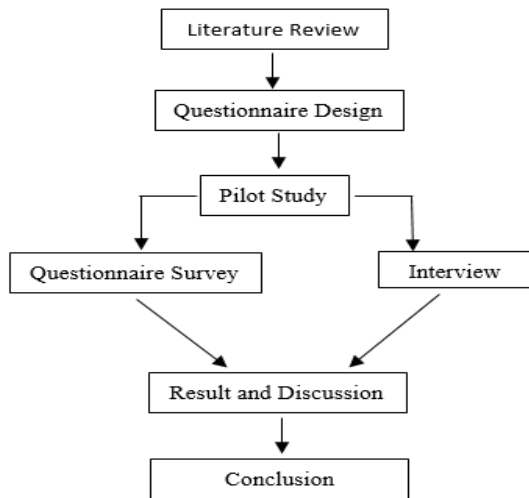


Figure 1: Flow Chart

Pilot Study

The pilot study is carried out before the research design is finalized to assist in defining the research question or to test the validity of the proposed study design. The pilot study was conducted by distributing the initial questionnaire to a selected expert having experience in the same field of the research to have their comments and feedback.. The first part Section A, which consisted of five (5) YES or NO type questions was designed and was asked to verify the validity of the questionnaire topics and their relevance to the research objective.

Approach

The qualitative and quantitative approach were used to collect data. The quantitative data was achieved through the survey questionnaires which was provided to the 25 respondents. qualitative data was collected through structured interview conducted with the 8 selected respondents of the identified construction project.

Data Analysis

The tools used for the data analysis are RII, Atlas and Microsoft Excel. The data collected from the questionnaire Survey was analyzed using RII Statistical tool to find the major factors impacting labor and material supply in the identified construction project. Thematic analysis was done using

ATLAS.ti 9 to analyze data collected from interviews. The data collected from the interview were used to obtain the views of the respondent on the effects of COVID-19 on the construction project. The following formula is used to determine the relative important index:

$$RII = \sum \frac{W}{A * N}$$

Where W is the weighting assigned by each respondent on a scale of one to five. A is the highest value and N is the total number of respondents.

Result and Discussion

The graph in figure 2 determines the five major factors impacting the materials supply due to COVID-19. The ranking of the factor is determined according to the RII. Thus, the factors with high RII value are grouped as major factors which affect the construction sector in terms of materials supply. The relative importance index for “Difficult in import of materials due to border seal” is very high (0.91). The relative importance index for “In-efficiency of virtual/online communication with the supplier” is also very high (0.86) with a rank equal to (2). The respondent strongly accepted this as one of the factors affecting materials due to the COVID-19. The approach of procurement has been changed due to COVID-19 with relative Important Index (0.85) is given importance by the responded as the holding of materials in dry port has also affected the construction project mainly at JNEC. The relative importance for the factor “Delayed material supply due to holding in mini dry port” has also indicated a high RII value (0.84) which is ranked 4. High transportation cost which has RII equal to (0.82) is also seen as an important factor.

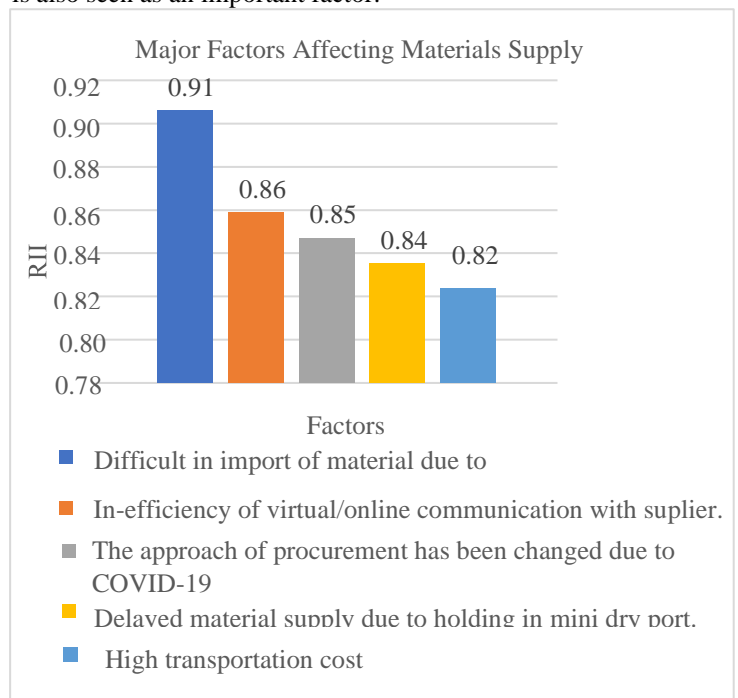


Figure 2: Major factor affecting materials supply due to COVID-19

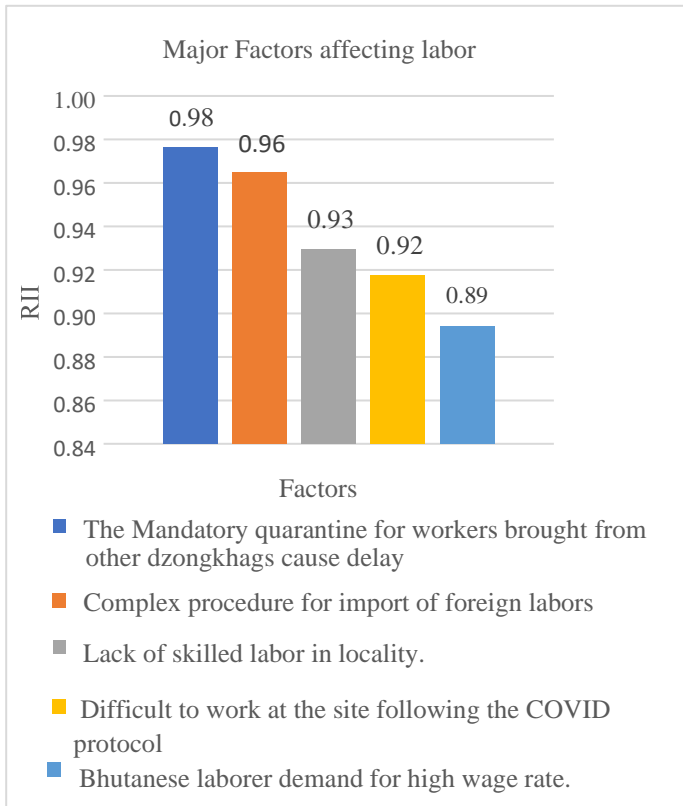


Figure 3: Major Factors Affecting Labor due to COVID-19

From Figure 3 displayed, the factor with RII (0.98) “Mandatory quarantine for workers brought from other dzongkhags cause a delay in reaching the Labor to the site” has a high rank (1) of all other factors. Similarly, with high RII (0.96) “Complex procedure for obtaining the Labor permit” has obtained a rank equal to (2). “Lack of skilled Labor in the locality” has also very high RII (0.93) due to the government restriction on the import of foreign Labors. It is depicted that with RII (0.92) having a rank equal to (4) “Difficult to work at the site following the COVID protocol” emerged as one of the major factors affecting the output of the Labor at the construction site. The majority of the respondent marked “Bhutanese Laborer demand for high wage rate” as a significant factor with RII value (0.89).

Comparison of Financial plan with Actual Progress

According to their original work plan Nu. 25.5 million should have been spent on the project and 40 percent of the work should have completed. As of now Nu 3.8 million has been claimed by the contractor excluding the mobilization and material advances. As per their financial plan Nu 1.9 million should have been spent to complete 12 percent of their work. However, Nu 3.8 million has been spent to complete 12 percent of their work. Due to the impact of COVID-19 on transportation, materials cost and Labor, there has been an increase in the total expenditure of the construction by Nu 1.9 million.

Comparison of Physical Progress with schedule

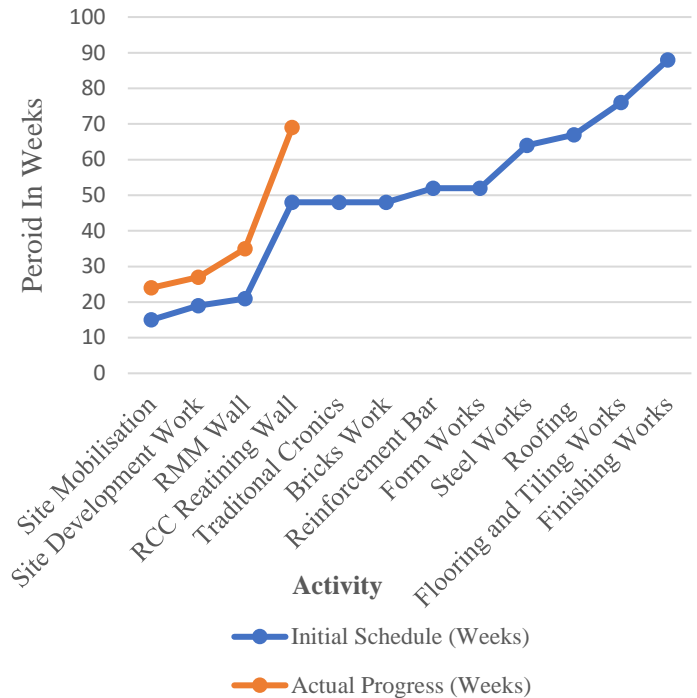


Figure 4: Comparison of Physical Progress of the Work against Original Schedule

Figure 4 shows the delay in execution of the work as per the schedule plan due to COVID-19. As per the scheduled plan, 40 percent of the work should have been completed as of April 2021 but due to the impact of COVID-19, only 12 percent of the work has been completed. As per the projected plan bricks work should have been completed but due to the lockdown, the project was suspended for a period of 21 days from August 11 to September 1. However, the delay in execution of the work as per the scheduled plan to complete the project on the period of 22 months, affects the college in shortage of classes for Mechanical Engineering students the upcoming semester and other related services to the students of Jigme Namgyel Engineering College.

Summary of the Findings

From the research it was found out that *difficult in import of material due to border seal, in-efficiency of virtual/online communication with the supplier, the approach of procurement has been changed due to covid-19, delayed material supply due to holding in mini dry port, High transportation cost* are the major factor affecting the materials supply due to COVID-19. In the same way, *the mandatory quarantine for workers brought from other dzongkhags causes delay in reaching the labor to the site, complex procedure for import of foreign worker, lack of skilled labor in the locality, difficult to work at the site following the covid protocol, Bhutanese laborer demand for high wage rate.*

From the comparative analysis of the physical progress with the initial plan, it was found out that the project is delayed by 28

percent in the execution of the work as per the initial plan which would result in a delay in completion of the project. The financial implication due to the outbreak of the pandemic as of now is Nu. 3.8 million of the budgets that have been used for completion of 12 percent of the total work, which is double the cost of their original financial plan. Therefore, the construction project will have a cost overrun to complete the work.

The COVID-19 has impacted the overall construction activity of the project, with the disruption in the supply of materials and inadequate labor to execute the construction activity. The project is likely to delay about 10 months. The delay due to pandemic could affect both the client and the contractor, it can lead to dissatisfaction for the client and the contractor shall incur a loss on completion of the project. With the delay in the construction project, the college is likely to face a shortage of classrooms for the upcoming semester and fail to provide other services to the students of JNEC.

Conclusion

The COVID-19 pandemic has resulted in substantial disruptions in the supply chain of material and labor in the construction project. The global COVID-19 pandemic has a significant impact on the construction industry, resulting in shrinkage of the economy. COVID-19 has had an impact on Bhutan's construction projects, and the construction industry has slowed as a result of the lockdown. This research looked closely at how the pandemic has impacted the construction project and analyzed the current situation where construction projects face problems. The study findings identified that the construction project experienced several adverse effects of COVID-19. These included Impact on Materials Supply, Labor and caused delay in completion of project.

Acknowledgment

We are deeply grateful to the Department of Humanities and Management faculties for the support and providing constructive feedback.s

We would like to extend our honest appreciation and gratitude to our project guide, Mr. Parashuram Sharma, assistant professor of Department of Electrical Engineering for his invaluable guidance and support

We would like to thank the Project Management Team of Jigme Namgyel Engineering College, Pema Junay Construction Private Limited for allowing us to access relevant data and providing their opinions for our research purpose. The undertaking could not have been possible without the participation and assistance of so many people whose names may not be enumerated. Their contributions are sincerely and gratefully acknowledged.

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