Challenges faced by Construction Organizations during Covid-19 Era

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Abstract The construction industries have been severely affected by the global pandemic Covid 19. The purpose of this paper is to identify and categorize the challenging factors faced by construction organizations during Covid 19 era and to explore the interrelationship among the factors using Total Interpretive Structural Modelling (TISM) approach. The results of the study depict shortage of labour, cautious buyers, material delay, uncertainty of demands and underutilization of renewable resources are independent factors that that are a major challenge for construction organizations. Furthermore, this is the first attempt to understand the challenging factors in construction organizations using the theory building approach like TISM.

Keywords: Construction organizations; Covid 19; Covid 19 challenges; Barriers in construction; Construction projects; Total Interpretive Structural Modelling

1. Introduction

The Covid-19 pandemic has hit hard in almost all the spheres of life. Its repercussions could be identified in various industries ranging from construction, manufacturing, production, real estate, tourism, airlines etc. To be more specific, the domestic construction activities have been affected to a level that cannot be even imagined. As a result of Covid-19 pandemic, different degrees of effect have been encountered by the construction industry stakeholders – including owners, developers, contractors, subcontractors, suppliers and vendors – depending on the responses at local and global levels. As the construction industry is faced with a new global and rather environmental changes, these impacts have resulted in the need for industry members to overcome both short and long-term market challenges. The pandemic has affected one of the major factors of production – labour. It has affected the labours emotionally, mentally, physically and financially, leaving a huge hit on their well-being. With the factories and workplaces closed down due to the impact of Covid 19, millions of migrant workers who are considered to be the backbone of the construction industry, were forced to leave their workplace to their own homes. They had to deal with various problems like loss of income, shortage in food, uncertainty about future and job security which resulted in affecting them mentally. The labour migration has resulted in the supply shortage which directly impacted the undergoing construction projects leading to losses that could have been avoided otherwise. The major impact could be identified when the related prices start to increase which resulted in the profit margin cut offs of those who engaged in these activities. This is one such example among many which shows how the Covid-19 impact on the construction industry has affected or created ripples in other industries.
The contribution of construction industry in the Indian GDP was the highest in the first quarter of 2019 which later decreased as the impact of the Covid 19 was increasing [1]. There will be deferred deadlines, fewer new projects taking off as the supply of products and services are disrupted. This could lead to changes in the pricing scales. New constructions may be put on hold as the supply of factors of production are being exhausted. It is therefore necessary to understand the spheres of the construction industry that are being affected by the Covid 19 pandemic so that the managers can strategize their actions, plan accordingly, take decision appropriately and avoid any mis happenings that could have been easily avoided.

2. Literature review

Covid -19 is an economic and social human catastrophe that has attacked the centre of human life. It threatens to multiply unexpectedly all over the globe and people have been globally affected [2]. Regarding the pandemic outbreak, several countries' leaders have agreed to protect lives before they save the economy, announcing sudden or staggered lockdowns in their nations. Policies such as social distancing and stay home have been introduced overnight, severely affecting many companies across sectors [3]. Many companies around the world are being increasingly challenged to keep their financial wheels spinning, despite reduced sales and the high incertitude degree. It is therefore of paramount importance for companies to execute appropriate evaluation and feasibility analysis of their business models [4]. The world requires more agility and yet optimism about the purpose and ways of coping with possible future pandemics which are infectious. The closing of the economy has also raised the risks of households and companies saving. Many enterprises either face insolvency or reduce their manufacturing capacity, leading to higher layoff or underemployment [5]. A lengthy lockdown also raises the likelihood of a significant increase in business and state debt resulting in vital economic disparities which could extend the healing time from the lockdown [4]. Companies producing and distributing information products and services have managed to operate while those manufacturing physical goods, particularly labour-intensive firms, have been forced to reduce or partially close down operations [6]. Disruptions to Covid-19 don't affect all companies equally. Those considered necessary, remained accessible, while others had to close. Many organizations could move workers to remote work, while others would be underprepared for the change [7]. The Covid-19 turmoil has directly challenged the potential for innovation and prevented startups that under ordinary situations might have been viable [8]. There are different prospects to rethink the notions that dominate everyone’s current life, such as the capital economy and its assets and how brittle they are [9].
3. Research Methodology

In this study TISM methodology is used to analyse the interrelationship among the challenging factors and ranking these factors. TISM approach have used by various manufacturing and service industries for factor relationship analysis ([10]; [11]; [12]; [13]; [14]; [15]).

The following steps are applied ([16]; [17]; [18]) for the development of TISM model of challenges faced by construction organizations:

1. Factors Identification: The identification of factors in two steps, first through literature review and next experts’ opinion for challenging factors that affects construction activities. The identified factors are shown in Table 1.

2. Establish interrelationships between factors: The contextual relationships between two factors are captured in the Initial Reachability Matrix (IRM). For this study, 22 responses have been collected and the respondents are construction project managers, engineers, supervisors, administrators in India. Table 2 depicts the IRM for challenging factors.

3. Interpretation: The interpretation of links between the pair of factors are established. How the factor-X influences on factor-Y?

4. Arriving the Final Reachability Matrix (FRM): A transitivity check must be done before arriving at the FRM. Transitivity check must be done on all the entries with ‘0’ in the IRM. 1* signifies the presence of transitivity, and the lack of it means that the original value of ‘0’ can be retained. 1* implies first level transitivity wherein if \( J = K \) and \( K = L \) then \( J = L \). 1** implies second level transitivity wherein if \( J = K \) and \( K = L \) and \( L = M \) then \( J = M \). Table 3 contains the FRM.

5. Partition Reachability Matrix: The FRM has been divided into three sets, viz. reachability set, antecedent set and interaction set. Beginning from level 1, factors of each level are extracted by way of repeated iterations and this process is continued until the partitioned reachability matrix is arrived.

6. Interaction matrix: The interaction matrix is derived from FRM considering significant transitive relationships and direct relationships between the factors. It’s shown in Table 4.

7. TISM model: The directed graph (digraph), is developed from level partitions and interaction matrix. In the Figure 1, first level factor is in the top of the digraph and next level is shown below the first level. The TISM model consists of digraph and interpretation. The interpretation between the factors are discussed in the Section 4.1.
| SL.No | Factors          | Definitions                                                                                                                                 |
|-------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Legal issues (F1) | Customer take Legal actions when delivery doesn’t occur in time. When sales don’t happen, builders are not able to pay back their dues on the hypothesized properties which might result in huge loss so banks might go forward with sealing the property. |
| 2     | Material delay (F2) | Due to lockdown many factories shut down partially or completely leading to shortage in raw materials. Interstate transportation has come to standstill there by effecting movement of goods from one state to another |
| 3     | Customer marketing (F3) | Due to quarantine builders are not able to canvas about their properties like before. Building and home exhibition could not be organised. Face to face interactions reduced. |
| 4     | Cautious buyers (F4) | Loss of job security and reduction salaries has caused a financial crunch causing potential buyers to put acquiring properties on hold |
| 5     | Shortage of labour (F5) | With onset of COVID-19 migrant labourers clamoured to go back to their respective home states, creating huge shortage in supply of labour. |
| 6     | Impact on dependent businesses (F6) | Iron and steel industry, wood industry, fabrication units, sanitary wares, electrical fittings, interior design firms are all directly or indirectly effected due to dwindling construction activity |
| 7     | Project delay (F7) | Due to shortage of labour, material delay, quarantine rules and financial struggles of clients and firm the supply chain was affected leading to huge project delays |
| 8     | Uncertainty of demands (F8) | As long no vaccine is found there will be an uncertainty about the future so prospective buyers will be cautious with their spending as future is not secure financially and health wise. It is hard for the firms to forecast future demand, so builders will also have to think twice before launching new projects |
| 9     | Quality of material degradation (F9) | Current inventory such as iron and steel would have corroded and rusted during the lockdown period there by reducing their tensile strength, cement when exposed to moisture will lead to initial setting. |
| 10    | Underutilization of renewable resources (F10) | Extremely expensive and huge machines used in pilling or hauling have been stagnant during lockdown which leads to wear and tear of parts and Wastage of manpower with zero performance from them during initial lockdown. Even after lockdown the number of workers had to be reduced. |
| 11    | Financial loss (F11) | Firm paid salaries to workers to prevent them from going home, Builders would have taken huge loans to buy or rent machineries and material, and will find it hard to pay back when they are not earning any income |

| Table 2. IRM for factors affecting construction organizations due to Covid-19 |
|-------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|       | F1   | F2   | F3   | F4   | F5   | F6   | F7   | F8   | F9   | F10  | F11  |
| F1    | 1    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 1    | 0    | 1    |
| F2    | 0    | 1    | 0    | 0    | 0    | 0    | 1    | 0    | 1    | 1    | 1    |
| F3    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| F4    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 1    | 0    | 0    | 0    |
| F5    | 1    | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 0    | 1    | 0    |
| F6    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    |
| F7    | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 1    | 0    | 1    |
| F8    | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 1    | 0    |
| F9    | 0    | 0    | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 1    | 1    |
| F10   | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 1    | 1    | 1    |
| F11   | 1    | 0    | 0    | 0    | 1    | 1    | 0    | 1    | 0    | 1    | 0    |


Table 3. FRM for factors affecting construction organizations due to Covid-19

|    | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 |  Driving Power |
|----|----|----|----|----|----|----|----|----|----|-----|-----|----------------|
| F1 | 1  | 0  | 1* | 0  | 0  | 1* | 1  | 0  | 1  | 0   | 1   | 6   |
| F2 | 1* | 1  | 1* | 0  | 0  | 1* | 1  | 0  | 1  | 1   | 1   | 8   |
| F3 | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   | 1   |
| F4 | 1* | 0  | 1**| 1  | 0  | 1* | 1  | 1*| 0  | 1*  | 0   | 8   |
| F5 | 1  | 1  | 1**| 0  | 1  | 1* | 1  | 0  | 1* | 1   | 1*  | 9   |
| F6 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0   | 0   | 1   |
| F7 | 1  | 0  | 1* | 0  | 0  | 1  | 0  | 0  | 1  | 0   | 1   | 6   |
| F8 | 1  | 0  | 1* | 0  | 0  | 1  | 1  | 1  | 0  | 0   | 1   | 7   |
| F9 | 1  | 0  | 1  | 0  | 0  | 1**| 1  | 0  | 1  | 0   | 1   | 6   |
| F10| 1* | 0  | 1* | 0  | 0  | 1* | 1  | 0  | 1  | 1   | 1   | 7   |
| F11| 1  | 0  | 1* | 0  | 0  | 1  | 1  | 0  | 1  | 0   | 1   | 6   |
| Dependence | 9 | 2 | 10 | 1 | 1 | 10 | 9 | 2 | 9 | 3 | 9 |

*, ** represents transitive links

Table 4. Interaction matrix

|    | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 |
|----|----|----|----|----|----|----|----|----|----|-----|-----|
| F1 | 1  | 0  | 1* | 0  | 0  | 1* | 1  | 0  | 1  | 0   | 1   |
| F2 | 0  | 1  | 0  | 0  | 0  | 1* | 1  | 0  | 1  | 1   | 1   |
| F3 | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   |
| F4 | 0  | 0  | 0  | 1  | 0  | 1* | 0  | 1  | 0  | 0   | 1*  |
| F5 | 1  | 1  | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 1   | 0   |
| F6 | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0   | 0   |
| F7 | 1  | 1  | 1* | 0  | 0  | 1  | 1  | 0  | 1  | 0   | 1   |
| F8 | 1  | 0  | 1* | 0  | 0  | 1  | 1  | 1  | 0  | 1   | 0   |
| F9 | 1  | 0  | 1  | 0  | 0  | 1* | 1  | 0  | 1  | 0   | 1   |
| F10| 1* | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 1   | 1   |
| F11| 1  | 0  | 1* | 0  | 0  | 1  | 1  | 0  | 1  | 0   | 1   |

* represents significant transitive links
4. Results and Discussions

4.1 Interpretation of TISM Di-graph

Figure 1 represents the graphical representation of TISM analysis of the factors having an impact on the construction organizations due to Covid-19.

**Level V:** Level five has one factor, which is factor 5.

Shortage of labour affects the legal problem when contracts are not finished on schedule and execution does not happen on time, customers become unhappy and take legal actions. Bank can also launch civil action against the client and the builder for default on the repayment of the loan. Shortage of labour affects material delays as the number of employees in factories has been reduced due to social distancing which in turn, have had an impact on productivity and affected the easy availability of materials such as...
iron, steel, etc. Decline in the number of drivers also contributed to a pause in material delays, as most of them were not in favour of driving during the lockdown and were subject to new laws.

Shortage of labour affects the project delay, since the loss of workers leads to reduced productivity in all aspects of manufacturing, transport, construction and canvassing, which implies that work is not finished on schedule. Shortage of labour affects underutilization of resources. Manpower was not accessible during the lockdown to run heavy machinery which have high maintenance and high rent. Employees and staff left for their homes, leaving jobs unfinished, allowing resources such as cement, concrete, vehicles, and machines to degrade.

**Level IV:** Level four has two factors, which are factor 4 and factor 2.

Cautious buyers have an influence on impact on dependent business when no one is willing to invest, either by taking loans or by using funds at hand because future is uncertain, this in turn effects many dependent businesses such as hardware, sanitary, cement, iron and steel etc as construction demand decreases, demand for this allied industry also comes down. Cautious buyers influence the uncertainty of demands. People have insecurity over work, finance and wellbeing, so they become cautious and defer investment. The outlook for demands is now very volatile and contractors can't launch new ventures in time. Cautious buyers have an impact on financial loss. With reduction in number of buyers the income for firm has drastically dropped. Firms must pay debts, salary and rent, which are being hard because of Covid-19.

Material delay has an impact on dependent business. A delay would result in the target deadlines not being met and pausing the next phase of construction. Hence dependent business for example, sanitary or electrical will find uncertainty and fluctuations in demand for their products. Material delay effects project delay directly. Without materials it is not possible to complete the project as there will be a lag. For example, without steel or cement one cannot proceed to finish construction, or without tiles one can’t set out to finish tiling. Material delay has indirect and direct effect on quality of material degradation. Directly the materials that are yet to arrive such as one that is in transport or stored in supplier’s storage can get degraded if not properly stored. Indirectly affects any material currently in the building site, for example, if there is already an opened bag of cement but not enough to take as input, one needs to wait for another bag to come, the existing bag could be lost if it is left open for a long time.

Material delay effects underutilization of renewable resources as expensive and huge machines used in pilling or hauling that have been stagnant during lockdown. Without material there is no use for these equipment’s and the firm is not getting any benefits from the resources. There will be sunk cost for company. Material delay effects financial loss directly, if material doesn’t come in time, the project does not get completed according to deadline. The company won’t be able to make turnovers or profit leading to financial loss. Some resources like machine, equipment’s and manpower will be idle if material doesn’t arrive at right time, but company might be paying for those resources even when its idle, leading to financial loss.

**Level III:** Level three has two factors, which are factor 8 and factor 10.
Uncertainty of demands has an impact on legal issue, as many firms would have taken loan and would not be able to pay it back, which will lead to legal issue. Uncertainty of demands has impact on customer marketing, Due to COVID-19 restrictions salesmen are not able to canvas properly and as demand fluctuates it is not easy to find the right buyer. Uncertainty of demand has effect on dependent business, with construction firm themselves facing fluctuations in demand it is hard for them to place order with the support business such as electrical, plumbing or sanitary. Uncertainty of demand influences project delay. When there is fluctuation in demand there won’t be enough cash flowing to sustain the flow of material, hence it will lead to project delay. Uncertainty of demand has effect on quality of material degradation, for example if there is fluctuation in demand, certain materials and resources will not be utilized and will be left to degrade over time if not used. Uncertainty of demand has effect on financial loss as many firms would have taken loans to pay for material and equipment rent that weren’t used during lockdown. Also, firms will have to pay the salaries of employees and workers when there is no work.

Underutilization of renewable resources effects legal issue indirectly, as many resources including equipment and manpower are idle during the lockdown there will be delay in project completion and lead to customers filling complaints or bank sealing property if loan can’t be paid back. Underutilization of renewable resources influences project delay directly. When the resources are kept idle, project deadlines can’t be met leading to project delays. Underutilization of renewable resources effects quality of material degradation. Underutilization leads to loss in productivity and reduces demand of materials and result in materials being kept idle for long times and reduce their quality due to wear and tear. Underutilization of renewable resources directly effects quality of material degradation, many raw materials such as iron rods or cement will not be utilized for construction as there is no proper utilization of manpower to carry out the works. Underutilization of renewable resources effects financial loss directly as salaries are being paid for workers even though they aren’t working at 100 percentage efficiency and there is rent and maintenance to be paid for equipment’s.

**Level II:** Level two has four factors, which are factor 1, factor 7, factor 9, and factor 11.

Legal issue has impact on dependent businesses, when firms face legal actions against them, the construction might come to halt which in turn effects purchasing capacity, and this will reflect on dependent business losing out on work. Legal issues effects project delay, if company gets caught in legal issue the work at site will also come to standstill, there by having delay to complete projects. Legal issues effects on quality of material degradation, when work get stalled at sites due to legal repercussions it will directly affect the quality of materials already procured like cement gets crusted, iron and steel gets corroded there by leading to loss. Legal issues effects underutilization of renewable resources, certain restrictions due to legal issue will seal the project site and prevent work to go on, hence manpower and equipment will be idle till issue is fixed. Legal issues effects on financial loss as certain machines would be taken on lease and salaries will have to be paid, irrespective of whether work happens or is stalled due to legal issue thereby causing drain in financial asset.

Project delay effects legal issue, when a firm is unable to finish their project on time, it leads to frustration among clients, and some might file case against them, also loans may be taken by firm from
bank so when sale doesn’t occur at right time firm finds it hard to pay back loan, causing further legal issues. Project delay effects customer marketing as a project gets delayed, the sales team cannot project the correct dates to customer, there will be uncertainty in scheduling and proper marketing cannot be done. Project delay has impact on dependent businesses, with project not proceeding on time, the firms purchase of products or services from other business like electrical, plumbing or interior designing also gets delayed. Project delay effects has impact on quality of material degradation, as the work gets delayed, material already in stock such as cement will get crusted, iron and steel will erode. Project delay effects financial loss directly. if there is inefficient management, carelessness, wrong material used or design issue the project gets delayed and have to be done again carefully leading to increase in cost which could have been avoided if the project wasn’t delayed.

Quality of material degradation effects legal issue, if materials are not used in proper time, they get corroded and degraded, if these low-quality materials are then used for construction, it will affect life and strength of the building, which can lead to legal suit against the builder. Quality of material degradation effects Customer marketing, if construction makes use of poor-quality material, it will be reflected in the building and will adversely affect brand image for firm and may cause safety issues, hence it will be difficult to communicate to the customers and advertise a high-quality building that is safe. Quality of material degradation has impact on dependent businesses as even these businesses would have materials in stock at their inventory to meet demands of construction firm, but during lockdown there were not much demand for them so materials get degraded and these business face hardships.

Quality of material degradation effects project delay, as materials already procured are not used the quality comes down and when these materials are used for construction later on, various issues will be faced as required strength may not be reached and workers have to redo the process, or some material cannot be used at all or may take time to be treated like steel, which will lead to project delay. Quality of material degradation effects financial loss directly as new material may be needed to replace the ones already procured whose quality has gone done exponentially, also some of the already procured materials may need to be treated before use, which will all add to extra expenses for firm.

Financial loss effects legal issue, as in a financial crisis for a firm they may not be able to pay back loans to the banks or pay for the product or service which were taken on credit from suppliers or other dependent business, hence a suit may be made against them. Financial loss effects customer marketing as during period of financial crisis firm won’t have much disposable income to invest in one on one advertising or mass advertising as they would like. Financial loss has impact on dependent business as the firms may not be able to pay back for the service or product they owned from other business. Also, a firm may go for cost cutting and cancel orders yet to be arrived from them. Financial loss effects project delay as firm may not have enough money to spend on material, workers, employees and for other paperwork, which may lead to shift in project schedule beyond the due date. Financial loss leads to quality of material degradation, as the work might be put to halt if there isn’t enough income to operate, hence the already procured material may not be used and left at site or storage leading to their demise.

**Level 1:** Level one has two factors, which are factor 3 and factor 6.
Customer marketing (F3) and impact on dependent businesses (F6), which was related to the objective of this study did not influence any factor. But, Factor 3 is influenced by factors 1, 7, 8 and 11. Factor 6 is influenced by factors 1, 2, 4, 7, 8, 9 and 11.

4.2 MICMAC analysis

MICMAC analysis used for classifying factors into four classes viz, autonomous, dependent, linkage and independent factors ([19];[20]). The four classes are shown in the Figure 2.

1. Autonomous factors (Class-I): Factors that have weak dependence and weak driving power are known as autonomous factors ([21];[22]). In this study, there is no autonomous factor.

2. Dependent factors (Class-II): Factors that have a higher dependence on other factors but lesser driving power are known as dependence factors ([23];[24];[25]). In this study customer marketing and impact on dependent businesses are the dependent factors. These factors get influenced when there is change in the other factors.

3. Linkage factors (Class-III): Factors that have a strong dependence and strong driving power are known as linkage factors ([26];[27]). They establish the connection between the dependence and the driving factors. In this study legal issues, project delay, quality of material degradation and financial loss are the linkage factors.

4. Independent factors (Class-IV): Factors that have a strong driving power, but weak dependence are known as independent factors ([28];[29]). In this study shortage of labour, cautious buyers, material delay, uncertainty of demands and underutilization of renewable resources are the independent or key barriers.

As per the MICMAC analysis, the factors influencing the affecting construction organizations due to Covid-19 is ranked [30] in Table 5.

Table 5. MICMAC rank for factors affecting construction organizations due to Covid-19

| Factor | Driving power | Dependence | Driving power / Dependence | MICMAC rank |
|--------|---------------|------------|----------------------------|-------------|
| F1     | 6             | 9          | 0.667                      | 6           |
| F2     | 8             | 2          | 4.000                      | 3           |
| F3     | 1             | 10         | 0.100                      | 7           |
| F4     | 8             | 1          | 8.000                      | 2           |
| F5     | 9             | 1          | 9.000                      | 1           |
| F6     | 1             | 10         | 0.100                      | 7           |
| F7     | 6             | 9          | 0.667                      | 6           |
| F8     | 7             | 2          | 3.500                      | 4           |
| F9     | 6             | 9          | 0.667                      | 6           |
| F10    | 7             | 3          | 2.333                      | 5           |
| F11    | 6             | 9          | 0.667                      | 6           |
According to the ranking, shortage of labour, cautious buyers, material delay are the top key factors. Also, uncertainty of demands and underutilization of renewable resources are the key factors. Customer marketing and impact on dependent businesses are the factor that is ranked seven in the MICMAC analysis ranking. It means that it has higher dependence on other factors. This is due to the fact that the changes in other factors can bring about changes in the F3 and F6.

5. Managerial implications

This research paper is on the impact Covid 19 has had on the construction industry. This study is helpful in understanding the bottlenecks and other difficulties that a manager or an organisation in the construction industry would face and this study can act as a guide in identifying the difficulties and overcome them. The results of the research will help the management prioritize their activities so as to streamline their project execution by minimizing the repercussions caused by the pandemic. The research has included various factors like cash flow, labour supply, raw material movements, contractual aspects, logistics, raw material degradation and wear and tear of machinery. This gives a clear picture to the management as to which areas need to be addressed in order to minimize loss which in turn helps a manager to anticipate on such unpredicted impacts and prioritise themselves depending on the factors discussed above. This helps an organisation to understand the pain points and act accordingly. This enables the smooth running of businesses by helping them to minimise losses and control their expenses and hence achieve the targets or goals even during such hard times.

6. Conclusion

This study understands and analyses the eleven factors that affects operations of construction projects in Covid 19 era. The TISM approach was used to find out the interrelationship among these factors and
the MICMAC analysis was used to rank it according to their order of importance. From this study it is found out that shortage of labour, cautious buyers, material delay, uncertainty of demands and underutilization of renewable resources are the main barriers in construction projects and the construction organizations should focus on these barriers to attain their smooth operations.

References

[1]. https://government.economictimes.indiatimes.com/news/economy/opinion-impact-of-covid-19-on-the-indian-economy/75021731

[2]. Suresh, M., Roobaswathiny, A., & Lakshmi Priyadarsini, S. (2021). A study on the factors that influence the agility of COVID-19 hospitals. International Journal of Healthcare Management, 1-10. https://doi.org/10.1080/20479700.2020.1870355

[3]. Leite, H., Hodgkinson, I. R., & Gruber, T. (2020). New development: ‘Healing at a distance’—telemedicine and COVID-19. Public Money & Management, 40(6), 483-485.

[4]. Donthu, N., & Gustafsson, A. (2020). Effects of COVID-19 on business and research. Journal of Business Research, 117, 284.

[5]. Bofinger, P., Dullien, S., Felbermayr, G., Fuest, C., Hüther, M., Südekum, J., & Weder di Mauro, B. (2020). Economic Implications of the Corona Crisis and Economic Policy Measures. Wirtschaftsdienst, 100, 259-265.

[6]. Seetharaman, P. (2020). Business models shifts: Impact of Covid-19. International Journal of Information Management, 54, 102173.

[7]. Bartik, A. W., Bertrand, M., Cullen, Z., Glaeser, E. L., Luca, M., & Stanton, C. (2020). The impact of COVID-19 on small business outcomes and expectations. Proceedings of the National Academy of Sciences, 117(30), 17656-17666.

[8]. Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Reyes, C. A. M., Prochotta, A., ... & Berger, E. S. (2020). Startups in times of crisis—A rapid response to the COVID-19 pandemic. Journal of Business Venturing Insights, 13, e00169. https://doi.org/10.1016/j.jbvi.2020.e00169

[9]. Buheji, M., & Ahmed, D. (2020). Foresight of Coronavirus (COVID-19) opportunities for a better world. American Journal of Economics, 10(2), 97-108.

[10]. Jena, J., Sudharth, S., Thakur, L. S., Pathak, D. K., & Pandey, V. C. (2017). Total interpretive structural modeling (TISM) approach and application. Journal of Advances in Management Research.

[11]. Patri, R., & Suresh, M. (2017). Modelling the enablers of agile performance in healthcare organization: A TISM approach. Global Journal of Flexible Systems Management, 18(3), 251-272.

[12]. Menon, S., & Suresh, M. (2019, October). Total Interpretive Structural Modelling: Evolution and Applications. In International Conference on Innovative Data Communication Technologies and Application (pp. 257-265). Springer, Cham.

[13]. S. Lakshmi Priyadarsini., & M. Suresh. (2020). Factors influencing the epidemiological characteristics of pandemic COVID 19: A TISM approach. International Journal of Healthcare Management. DOI: 10.1080/20479700.2020.1755804

[14]. Suresh, M., Srividya, R., & Kumaraswamy, S. (2021). Modelling the Factors of Job Stress in Audit Firms: A TISM Approach. In Advances in Materials Research (pp. 819-829). Springer, Singapore.

[15]. Suresh, M., & Abhishek, R. D. (2021). Modelling the Factors of Store Environment on Impulse Buying Behavior Using TISM. In Advances in Materials Research (pp. 741-751). Springer, Singapore.

[16]. Vaishnavi, V., Suresh, M., & Dutta, P. (2019a). A study on the influence of factors associated with organizational readiness for change in healthcare organizations using TISM. Benchmarking: An International Journal, 26(4), 1290-1313.

[17]. Vaishnavi, V., Suresh, M., & Dutta, P. (2019b). Modelling the readiness factors for agility in healthcare organization: a TISM approach. Benchmarking: An International Journal, 26(7), 2372-2400.

[18]. Vaishnavi, V., & Suresh, M. (2020). Modelling of readiness factors for the implementation of Lean Six Sigma in healthcare organizations. International Journal of Lean Six Sigma. https://doi.org/10.1108/IJLSS-12-2017-0146

[19]. Patri, R., & Suresh, M. (2018). Factors influencing lean implementation in healthcare organizations: an ISM approach. International Journal of Healthcare Management, 11(1), 25-37.

[20]. Suresh, M., & Krishnan, S. V. (2021). Modelling the Factors of Environmental Sustainability in Healthcare Dispensaries. In Advances in Materials Research (pp. 753-761). Springer, Singapore.
[21]. Lakshmi Priyadarsini, S., Suresh, M., & Huisingh, D. (2020). What can we learn from previous pandemics to reduce the frequency of emerging infectious diseases like COVID-19?. *Global transitions*, 2, 202-220.

[22]. Suresh, M., Sangeetha, D., & Kumaraswamy, S. (2021). Modelling of Factors Influencing Saving Behaviour of Women in India: An Interpretive Structural Modelling. In *Advances in Materials Research* (pp. 809-818). Springer, Singapore.

[23]. Keerthana, S., & Suresh, M. (2016, December). Drivers influencing lean practices in street food vending process. In *2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)* (pp. 1-5). IEEE.

[24]. Renganath, K., & Suresh, M. (2016, December). Analyzing the drivers for safety practices using interpretive structural modeling: A case of Indian manufacturing firms. In *2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)* (pp. 1-6). IEEE.

[25]. Suresh, M., & Yogesh, S. B. (2021). Modelling the Factors of Buying Behaviour of Paint Products. In *Advances in Materials Research* (pp. 1259-1267). Springer, Singapore.

[26]. Suresh, M., Ganesh, S., & Raman, R. (2019). Modelling the factors of agility of humanitarian operations. *International Journal of Agile Systems and Management*, 12(2), 108-123.

[27]. Venkatesh, A. B., & Suresh, M. (2016, December). Factors influencing Indian tourism promotion in social media. In *2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)* (pp. 1-5). IEEE.

[28]. Sudharsan, T. M., & Suresh, M. (2016, December). Factors influencing purchase decision of solar lanterns by street vendors. In *2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC)* (pp. 1-4). IEEE.

[29]. Suresh, M., Mahadevan, G., & Abhishek, R. D. (2019b). Modelling the factors influencing the service quality in supermarkets. *International Journal of System Assurance Engineering and Management*, 10(6), 1474-1486.

[30]. Patil, M., & Suresh, M. (2019). Modelling the enablers of workforce agility in IoT projects: A TISM approach. *Global Journal of Flexible Systems Management*, 20(2), 157-175.