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Cost-benefit analysis of High-Rise Structure due to Pandemic Impact on Construction Industry

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ABSTRACT: the principal causes of delays in this research study were analyzed after data collection using a questionnaire survey with a wide range of construction professionals based in High-rise Projects. The findings of this study could help the construction industry better analyze not just the principal reasons of delays on construction projects, but also how to minimize them through appropriate planning. Despite its importance in ensuring the safe application of working processes, safety leadership is occasionally overlooked in recommendations.

Aside from addressing increased demand, good decision-making during the construction phase can mitigate Delay concerns, however additional research is required. This could involve research on decision-making processes, the content of construction site management training programs, the value of training programs in building a more skilled workforce, and the use of pre-cast materials. An investigation into construction project delays in India during the outbreak.

Because high-rise projects are vital to the city, they must be completed quickly. Almost all Indian projects are late. Delay is the most common, complex, and dangerous problem in construction. Most construction projects in poor countries run late. Regardless of size or complexity, deadlines and unpredictability abound. Every construction project has delays, and the severity of these delays varies widely. This study reviews prior research on time and cost overrun drivers.

KEYWORDS: Low Rise & High Rise Buildings, Cost-benefit analysis

I. INTRODUCTION

Impacts of COVID-19 on High rise construction sector

COVID-19 victims are becoming more numerous by the day, which is having an influence on the building industry. Government lockdowns are disrupting the supply chain; labour shortages are emerging; companies are experiencing an economic downturn; and they are having difficulty keeping their contracts.

Management of the supply chain

In several places of the world, the supply chain has been interrupted in various ways. Various construction materials are necessary, but they are not reaching the construction site from outside due to lockdown, which is causing delays in the construction process. Various resources for construction work that come from various industries in the country or overseas via various vehicles, those items cannot come. Because all cars are unable to come to lockdown, the essential materials are unable to arrive, and the work is halted. It has not only caused the construction sector to shut down, but it has also harmed the livelihoods of those who transport these materials in cars, as well as the factories that produce these products, which are losing a lot of money because they are not being sold.

An issue with transportation

All modes of mobility in the country have been hampered as a result of the nationwide lockdown. As a result, no materials are being delivered to the construction industry, and no workers are able to work from home. As a result, the work has come to a halt.



Labor scarcity

To begin with, workers are unable to get to work since the transit system is entirely shut down. Second, because the sickness is caused by a viral infection, workers who come into touch with one another are more likely to spread it. As a result, many workers refuse to come to work. Furthermore, forcing workers to labour without any protection is impossible.

Financial difficulty

Companies are not making any profit as a result of the work stoppage; on the contrary, more losses are being incurred, and not only the company is losing money, but all of the suppliers who provide the required materials to various companies for use in the construction sector are also losing a lot of money. Since the company's shutdown, the supply chain has been disrupted, and factories that create goods have ceased operations, resulting in several job losses. Furthermore, the government is unable to collect adequate taxes from all of these sites due to the non-sale of factory-produced goods and the shutdown of the building sector, which has a direct influence on the country's GDP, which impacts the global economy.

Issues with contractual implication

It is primarily based on the 'force major' clause. This clause has a number of rules, one of which is 'Large Scale Epidemic.' This category includes the COVID-19 pandemic. Different contractors placed their various tools in various locations for usage in various machinery construction sectors, but because to the lockdown, all of these equipment have been laying around for a long period. Companies have contracts with contractors to work with all of this equipment for a fee, and if the contract includes a 'Force Majeure' clause, the contractor will not be compensated by the agency if the project is delayed. When contractors stop working, the effect is a significant financial loss.

III. ANALYSIS WORK

SPSS SOFTWARE-

Analysis of the questionnaires survey was done using IBM SPSS Software. SPSS Statistics is a software package used for statistical analysis. The software name originally stood for Statistical Package for the Social Sciences (SPSS), reflecting the original market. It is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. It is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. It is a widely used program for statistical analysis in social science. It is also used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners, and others. All the responses obtained from the questionnaires are entered in to the software. First, the variables or the questions are entered in the data view, then, the responses are entered into the software from the various data entered into the software, frequency can be found which is used to determine the importance factor.

SPSS data View:

The Questionary Survey responses were reported in excel file. After opening data, SPSS displays them in a spread sheet-like fashion as shown in below figure. The excel file was export in data View and check the values and other information in spread sheet.

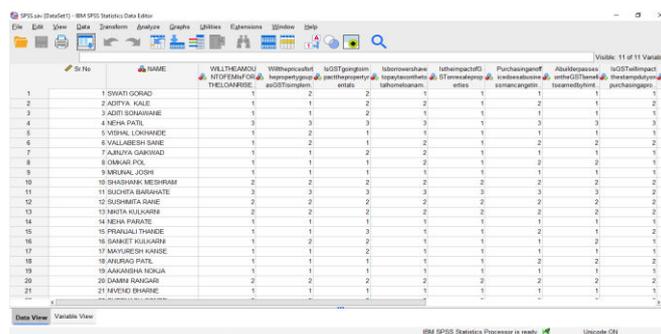


Figure1: SPSS Data view



1.	Do you believe that poor management system contributed to the High rise Structure late completion?
2.	Is it true that heavy rain causes building activity to slow down?
3.	Do you believe that using advanced construction techniques to build a High rise structure is the best option?
4.	Do you believe that this project's delays are due to government funding and payment issues?
5.	Do you think that project will be delayed as a result of the late release of the site, drawings, and materials?
6.	Is the project team heavily reliant on one another for assistance, intelligence, or enforcement to complete their tasks, causing a delay in the completion of the High rise structure?
7.	Do you believe the errors in layout caused by incorrect data in drawings lead to further work being done?
8.	Do you believe the project team members and staff lack expertise in the construction of an emergency on Site?
9.	Can you feel there is a lot of uncertainty on the project for the project team members?
10.	Do you believe that if advanced building techniques were used, any of the above factors will be eliminated?
11.	Do you believe that India's health infrastructure is sufficient to solve the Pandemic problem?
12.	Do you think that quality of the work would suffer as a result of the fast-track construction?
13.	Do you think the best choice for constructing a High rise building is to use advanced building techniques?
14.	Do you believe that the task of construction management is required to complete the project on time?
15.	Do you believe that a High rise Building should be built at the start of the Pandemic Situation on Site?

SPSS Variable View:

An SPSS data file always has a second sheet called variable view. It shows the metadata associated with the data. Metadata is information about the meaning of variables and data values. In Variable View, different columns are displayed. Each line corresponds to a variable. A variable is simply a quantity of something, which varies and can be measured, such as height, weight, number of children, educational level, gender and so forth. Name of the variable it is your own choice, but make it understandable and do not use numbers or symbols as the first letter since SPSS will not accept it. Moreover, you cannot use spaces in the name. The name of variable was used such as EMI, Construction material etc. The variable view spread sheet is shown in the below figure.

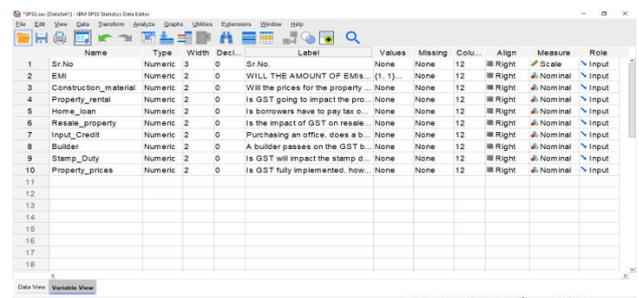


Figure2 : SPSS Variable View

SPSS Data analysis: SPSS can open all sorts of data and display them -and their metadata- in two sheets in its Data Editor window. In our data contain a variable holding respondents' on GST related

question, we can compute the frequency by navigating to Descriptive Statistics as shown in below fig**. For better understanding and detailed study pie charts and Bar chart option is also selected.

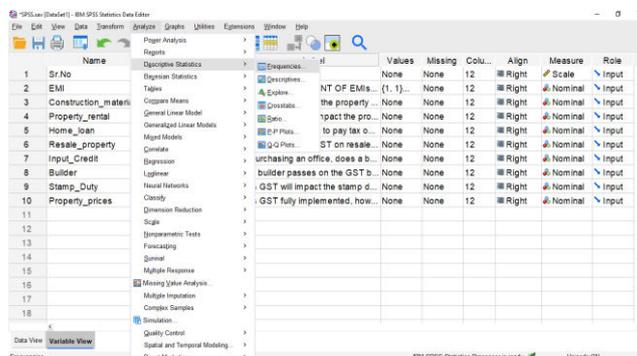


Figure3 : SPSS data analysis



Is it true that heavy rain causes building activity to slow down?

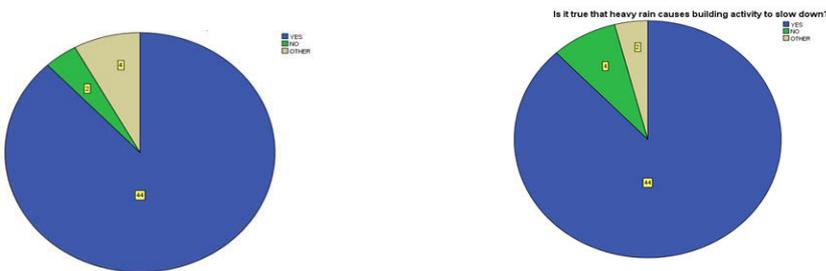
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	44	88.0	88.0	88.0
	NO	4	8.0	8.0	96.0
	OTHER	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

Do you believe that using advanced construction techniques to build a High rise structure is the best option?

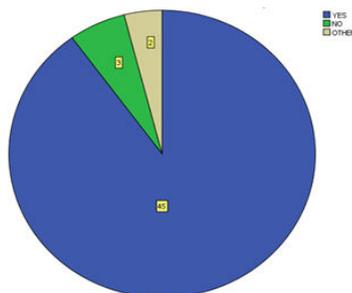
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	45	90.0	90.0	90.0
	NO	3	6.0	6.0	96.0
	OTHER	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

Do you believe that this project's delays are due to government funding and payment issues?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	33	66.0	66.0	66.0
	NO	7	14.0	14.0	80.0
	OTHER	10	20.0	20.0	100.0
	Total	50	100.0	100.0	



Do you believe that using advanced construction techniques to build a High rise structure is the best option?





RII Method

Sr. No.	Questions	YES(N1)	No(N2)	CANT SAY(N3)	Total
1	Do you believe that poor management system contributed to the High rise Structure late completion?	44	2	4	50
2	Is it true that heavy rain causes building activity to slow down?	44	4	2	50
3	Do you believe that using advanced construction techniques to build a High rise structure is the best option?	45	3	2	50
4	Do you believe that this project's delays are due to government funding and payment issues?	33	7	10	50
5	Do you think that project will be delayed as a result of the late release of the site, drawings, and materials?	39	8	3	50
6	Is the project team heavily reliant on one another for assistance, intelligence, or enforcement to complete their tasks, causing a delay in the completion of the High rise structure?	33	11	6	50
7	Do you believe the errors in layout caused by incorrect data in drawings lead to further work being done?	44	2	4	50
8	Do you believe the project team members and staff lack expertise in the construction of an emergency Site ?	37	8	5	50
9	Can you feel there is a lot of uncertainty on the project for the project team members?	31	13	6	50
10	Do you believe that if advanced building techniques were used, any of the above factors will be eliminated?	43	3	4	50
11	Do you believe that India's health infrastructure is sufficient to solve the Pandemic problem?	9	36	5	50
12	Do you think that quality of the work would suffer as a result of the fast-track construction?	39	8	3	50
13	Do you think the best choice for constructing a High rise building is to use advanced building techniques?	46	2	2	50
14	Do you believe that the task of construction management is required to complete the project on time?	46	2	2	50
15	Do you believe that a High rise Building should be built at the start of the Pandemic Situation on Site?	43	1	6	50

Sr. No.	Over time	YES(N1)	No(N2)	CANT SAY(N3)	Total	Sr. No.	Over time	YES(N1)	No(N2)	CANT SAY(N3)	Total	Total Number(N)	Avg	RII	Rank
1	Do you believe that poor management system contributed to the High rise Structure late completion?	44	2	4	50	1	01	44	4	12	60	50	150	0.4	9
2	Is it true that heavy rain causes building activity to slow down?	44	4	2	50	2	02	44	6	6	50	50	150	0.39	10
3	Do you believe that using advanced construction techniques to build a High rise structure is the best option?	45	3	2	50	3	03	45	6	6	57	50	150	0.38	11
4	Do you believe that this project's delays are due to government funding and payment issues?	33	7	10	50	4	04	33	14	30	77	50	150	0.31	2
5	Do you think that project will be delayed as a result of the late release of the site, drawings, and materials?	39	8	3	50	5	05	39	16	9	64	50	150	0.43	6
6	Is the project team heavily reliant on one another for assistance, intelligence, or enforcement to complete their tasks, causing a delay in the completion of the High rise structure?	33	11	6	50	6	06	33	22	11	73	50	150	0.49	4
7	Do you believe the errors in layout caused by incorrect data in drawings lead to further work being done?	44	2	4	50	7	07	44	4	12	60	50	150	0.4	9
8	Do you believe the project team members and staff lack expertise in the construction of an emergency Site ?	37	6	5	50	8	08	37	16	15	68	50	150	0.45	5
9	Can you feel there is a lot of uncertainty on the project for the project team members?	31	13	6	50	9	09	31	24	11	75	50	150	0.5	3
10	Do you believe that if advanced building techniques were used, any of the above factors will be eliminated?	43	3	4	50	10	10	43	6	12	61	50	150	0.41	8
11	Do you believe that India's health infrastructure is sufficient to solve the Pandemic problem?	9	36	5	50	11	11	9	72	15	96	50	150	0.64	1
12	Do you think that quality of the work would suffer as a result of the fast-track construction?	39	8	3	50	12	12	39	16	9	64	50	150	0.43	6
13	Do you think the best choice for constructing a High rise building is to use advanced building techniques?	46	2	2	50	13	13	46	4	6	56	50	150	0.37	12
14	Do you believe that the task of construction management is required to complete the project on time?	46	2	2	50	14	14	46	4	6	56	50	150	0.37	12
15	Do you believe that a High rise Building should be built at the start of the Pandemic Situation on Site?	43	1	6	50	15	15	43	2	11	63	50	150	0.42	7

Indeed, with less physical activity, the new manufacturing processes decrease waste using new construction materials. In order to achieve sustainable development and to reduce waste, the policies outlined in this study need to be understood and fully implemented. Not only must all these practices be followed by administrators, but also by the workers.

- ✓ Concentrated networks for factories
- ✓ Community in Technologies
- ✓ Consistency at foundation
 - JIT Producing
 - Uniform factory filling
- ✓ Manufacturing Kanban control scheme
- ✓ Minimized Times for Setup

The questionnaire was circulated across large construction projects, including site engineers, Painter, Plasterer, Meson Brickwork, steel binder, and the employee workforce, as well as small construction projects.

The findings summarized and the author's influence measured, grouped into seven categories of factors affecting the Cost and Time efficiency of construction workers at the construction site, as follows:



Table1: Ranking of factors on workers themselves

Factors	RII	Impact	Ranking
Experience of workers	4.29	Very high	5
Labour Discipline	4.12	Very high	5
Physical ability	4.01	High	4
Psychophysiology ability	3.78	High	4
Labour Intensity	3.52	Mid	3
Age	3.41	Low	2
Gender	3.19	Extreme Low	1
Level of training	3.09	Extreme Low	1

The lower the labor rate, the lower the productivity, the human being's physiological psychological problems would have an effect on the standard of work, thereby impacting productivity. The higher the age, the more experience is acquired, however physical strength can be reduced, thus greatly affecting labor productivity.

Table2: Ranking of operational and managerial factors

Factors	RII	Impact	Ranking
Ability to organize production	4.23	Very high	5
Construction supervision	4.20	High	4
Application of technology	3.92	Mid	3
Workers' arrangement	3.73	Low	2
Labour's Communication	2.89	Extreme low	1

The ability to organize production is the leading influence with RII= 4.23, and the organization of construction supervision with RII= 4.20 is ranked second. It can be seen that the capacity to organize and oversee the construction of contractors, especially the site manager, can decide management and organization, development and direct construction on the site. These have a clear effect on the increase or decline in labour production and have a major impact on it. With RIIs being 3.73 and 3.92, the factors to be calculated with a high degree of control are the application of technologies and worker structure. That is to say, from the viewpoint of workers, technologies and labor agreements contribute significantly to their performance.

Table3: Ranking of factors that motivate employees

Factors	RII	Impact	Ranking
Types of salary payment	4.27	Very high	5
Staff Support	4.05	High	4
Reward Mechanism	3.69	High	4
Spiritual Life	3.58	Mid	3
Training and improving skills	3.32	Low	2
Initiative at work	3.18	Extreme low	1

Factors that have a high effect on time & cost efficiency include skilled training, skills upgrading and innovation. These variables directly impact employee motivation, taking work to the satisfaction and sense of obligation of construction workers



Table4: Ranking of factors of working tools and objects

Factors	RII	Impact	Ranking
Quality of building materials	4.25	Very High	5
Quality of working tools	4.01	High	4
Complexity of works	3.72	Low	2
Material transport methods	3.02	Extreme Low	1

The difficulty of the work with RII = 3.78 and the material transfer methods with RII = 3.22 are high-impact variables. These factors influence job efficiency, which, as stated, would also impact of new construction materials. Organizations need to use machinery, equipment and resources that must be appropriate for goods and technology in order to ensure the achievement and growth of productivity; ensure regular readiness and service during the work shift; ensure that raw materials and semi-finished products put into production must have obvious origin and qualification.

Table5: Ranking of natural environmental factors

Factors	RII	Impact	Ranking
Weather conditions	4.82	Very High	5
Regulations,	3.42	High	4
Geological and	3.27	Mid	3
hydrological conditions	3.12	Low	2
laws on construction	3.02	Extreme Low	1

SR.N O	MATERIAL	BEFOR E PANDA MIC	AFTER PANDEMI C	PERCENTAG E INCREASE
1	STEEL	40	85	113%
2	CEMENT	270	365	35%
3	METAL	2300	2500	9%
4	NATURAL SAND	4000	5000	25%
5	CRUSH SAND	2900	3500	20%
6	BRICK	8	14	75%
7	ELECTTIC POINT	550	750	36%
8	PLUMBING MATERIAL			110%
9	NAL OR TAB FITTING METRIAL			55%
10	FLOORING	110	150	20%
11	GRILL	60	100	67%
12	PAINTING	22	35	30%
13	WINDOW	170	230	35%
14	DOOR	120	170	42%
15	RCC LABOR	120	140	17%
16	BRICK WORK	100	130	30%



	PLASTER LABOR			
17	TILE WORK LABOR	40	60	50%
	TOTAL AVERAGE INCREASE IN COST			45%

III. CONCLUSION

- The experience of Pandemic in the construction industry is not yet over as the learning curve has not completed the circle
- Where such can work, and workspace management, additional design considerations and Services to the Situation
- A limitation encountered during this research is the minimal number of the data collection when compared with arrays of construction professionals all over the world. It would be expected that such data could have a larger number of survey participants than the number evaluated.
- Likewise, planning with unforeseen circumstances including other contingency covering that, and the reduction of on-site work through the use of prefabricated elements
- Further study could expand to involve more participants so as to explore further updates on the impact of Pandemic in the construction industry from mid-2020 onward. Another limitation is the shortage of literature to revert to in-depth for this particular study.
- This is an unprecedented event which caught the entire world unaware and including the ardent risk takers in the construction industry.
- In the end, if these experiences are harmonized, a comprehensive turnaround strategy for contingency plan would be produced
- It seen that for there is increase in rate for construction materials after pandemic period that before pandemic.
- There is almost 45% increase on an average after pandemic period.

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