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Cost Escalation Due to COVID-19: Causes and Its Impacts on Construction Sector

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Abstract: The construction industry has a major role in the development of the Indian economy. The construction industry is the second largest industry of the country after agriculture. It makes a significant contribution to the national economy and contributes more than 5 percent to India's GDP. The Indian construction industry employs over 30 million people and creates assets worth over 200 billion.

Construction projects have been inundated by cost and schedule overruns. In too many cases, the final project cost has been higher than the cost estimates prepared and released during initial planning, final design and estimation or even at the start of construction. Over the time span between project initiation, concept development and the completion of construction many factors may influence the final project costs. Organizations face a major challenge in controlling project budgets over the time span between project initiation and the completion of construction.

In theory cost may overrun or under run in construction projects. But the frequency of overrun is much higher when compared to under run. Cost escalation can be defined as changes in the cost or price of specific goods or services in a given economy over a period of time. Cost increase usually occur as a result of market forces and reflect increases in the cost of material/ labour and higher levels of construction activity. In this paper we studied what are the causes of cost escalation, various formula which are used to calculate cost escalation as well as how COVID-19 has affected construction industry.

Keywords: construction projects, GDP, cost overrun, schedule overrun, project cost, project budget, cost escalation, COVID-19.

I. INTRODUCTION

The Indian construction sector is an integral part of the economy and a conduit for a substantial part of India's development investment. The construction sector plays a pivotal role in developing the country's infrastructure, a pre-requisite for high levels of economic growth. India being a developing country is in a great need to develop the required infrastructure to cope up with the present growth demand of the country. To achieve the same government is stepping into development of mega construction projects having long gestation period and huge investment.

Major construction projects usually have long gestation periods which gave rise to many problems during construction. Rising market trends in prices is a common phenomenon in the developing countries. Multifarious risks and uncertainties are likely to arise over such long periods, a major chunk of these risk are mainly due to a sudden increase in the price of material, wages of labor and POL (Petrol, Oil and Lubricants) during the course of the project. The increase in the prices being always unforeseen and unpredictable and it is difficult to anticipate rate of increases at the time of quoting rates. It is therefore obvious that the contracting agencies cannot be expected to carry out the work rates quoted at the time of tender without getting compensation for escalation in prices during the execution of a project.

Generally, in the construction industry, the contractor works in an environment of risk and uncertainty caused by the economic factors such as fluctuations in the costs of materials, labour and equipment. Contractors and suppliers working in today's volatile materials market find that estimating, bidding and financing the construction projects are challenges. Many face significant losses or erosion of anticipated profits because many of them are locked into fixed price construction contracts where contractors bear the risk of material price and supplier cost increases.

II. OBJECTIVE OF STUDY

- To understand the concept of cost escalation.
- To study escalation formulas presently used in construction work adopted by various government/ department agencies in India.
- To prepare a data regarding price variation in construction commodities like cement steel, POL etc.

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- To give suggestion those can be used to overcome the problem of price variation in current escalation system in building construction.

III. METHODOLOGY

In this paper, data will be collected from various construction sites. Market rates of various cement types, steel will be collected from vendors. Adjustments for various components like cement, steel, POL etc. will be calculated using formulas. Value of Price Index will be taken from Economic Advisor of India. At last from data, it will have studied how much there is percent increase in materials, labour and other commodities. The focus is on deriving conclusions from the study undertaken and making recommendations to stake holders in construction industry regarding their responsibilities to overcome the problem of construction project cost escalation.

IV. LITERATURE REVIEW

1. Sampatti Goyal in study on "Effect of Inflation on Project Costs in Rajasthan", data on time and cost overruns of different infrastructure projects from different sectors have been taken for analysis. In this analysis budgeted cost and actual cost of selected project have been compared and cost overrun has been calculated. It is found that increase in material cost is primary reason for cost overrun during project progress, rates of iron and steel, cement, bitumen, concrete, crude oil etc. fluctuates very sharply. In a project Barsingsar had awarded at project cost of ₹1114.18 Crore, which was approved in December 2004, but project cost of completion was ₹1626.09 Crore, hence there is increase in cost by ₹511.91 Crore, in terms of percentage it is 46% and 66% of mentioned percentage was over all WPI inflation (all commodities) during project completion period. It was observed that in short run projects, inflation may not create much of difference as material costs can be contractually fixed. But in long run projects and delayed projects, inflation plays a vital role as vendors will be forced to increase their prices from time to time and as such prices cannot be contractually fixed, rather an estimated margin has to be taken into account for the length of the project.

2. Ade Asmi Abdul Azis, Aftab Hameed Memon, Ismail Abdul Rahman & Ahmad Tarmizi Abdul Karim in their work "Controlling Cost Overrun Factors in Construction Projects in Malaysia", Poor cost performance in construction project is a common problem worldwide resulting in significant amount of cost overrun. Author presented qualitative research method using semi-structured interview with experienced personnel's involved in handling construction projects. A total of 21 respondents from client, consultant and contractor organizations were interviewed and requested to evaluate the eight (8) categories of cost overrun factors, the respondent had ranked "contractor's site management" as most severe contributor of cost overrun and followed by "information and communication" category while the least severe category is financial management.

3. Surabhi Kharbanda & Ketan Jain in their work "Study of Price Escalation in Construction Projects", it is expressed that Escalation is a key term of construction contract due to periodically fluctuating pieces if backbone components of construction industry such as steel, cement, labours and POL. In order to manage or measure escalation on construction projects, it is important to find out driving forces behind it which is very difficult to predict or estimate what prices for the bid to be considered, as current market is very fluctuating. Escalation is generally applicable for the projects of long duration, so for smaller duration projects it is preferable to quote rates including future escalating price factor or quote the rates on the basic prices of materials & labor prices & contractor has to claim whatever variation in price of the same. WPI is the heart of escalation which should be taken as a reference for finding out price escalation. WPI is displayed & periodically i.e. monthly updated by RBI or GOI and WPI plays important role into framing their monetary and fiscal policies. The WPI indices are also used for the purpose of escalation clauses in the supply of raw materials, machinery and construction work. The weekly index numbers of wholesale prices have acquired considerable significance over time, since this is the only index which gives an idea of the week-to- week fluctuations in the prices of all the traded commodities and which will help to obtain nearly forecasts rate for fixed price contracts.

4. Joe M. Vazathara & Jeena Mathew in their study "Developing A Computer Based Technology for Cost Escalation in Construction Industry ", It was found that most of the companies use manual calculation for calculating cost escalation. But still it needs some improvement for this calculation method. For small construction projects manual calculation takes less time, but in large construction projects the manual calculation is difficult for manage. So the survey also identifies the important factors for cost escalation. This leads a possibility for developing cost escalation system for different construction projects. it is expressed that Cost Escalated System (CES) will fulfil the needs of the construction contract organizations, through this study important factors that change the cost is established and it is concluded that a) fuel rate, b) inflation in labour rates, c) shortage of material supply, d) inflation of material price and e) inflation of plant and machinery cost are of important factors.

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5. Dr. Abdulaziz A. Bubshait and Yaser A. Al - Juwairah in their work "Factors contributing to construction cost in Saudi Arabia", discusses the main factors that affect construction costs in Saudi Arabia. As the building projects get larger and more complex, the probability of having so many factors also increases. Forty-two factors affecting construction costs and their degree of importance were evaluated. The author categorized these factors into five major categories: environmental factors; construction factors; factors of construction items; cost-estimating factors; and financing factors. Then the severity of those factors is measured by their level of importance and ranked according to the severity index for contractors, consultants/engineers, owners, and a combination of all respondents. The results thus suggested that the five most severe factors affecting construction cost in Saudi Arabia as agreed by owners, contractors and designers are cost of materials, incorrect planning, and previous experience with the contract, contract management and poor financial control on site.

V. COST ESCALATION

Cost escalation of construction projects can be defined as the departure of final project costs (after construction) from the initial budget estimates. This can be caused by a number of factors ranging from design changes to high cost of materials, machinery and labour (i.e. more than initially anticipated). As cost escalates, all budgetary and fiscal plans can be thrown in to chaos, causing the construction market to suffer for the lack of predictability. Escalation is the change in cost or price of specific goods or services in a given economy over a period.

Escalation affects the budget and causes severe financial overrun by the contractor. It also adds to contingency in the contractor's bid and is a major contributor to the overall cost uncertainty of the project execution especially in projects in which variability and uncertainty is greater. Due to frequent rise in the prices of materials and wages of labour, the contract rates of the various items of work are affected adversely for the contractor who could not visualize such a steep rise and therefore could not include the same in his tender rates.

Table I: Escalation Formulae Used in Various Departments

Item Compensated	Central Public Works Department	Military Engineering Services	Tamil Nadu Public Works Department
Cement	$V_C = W \times \frac{X_C}{100} \times \frac{CI - CI_0}{CI_0}$	Nil	$V_C = 0.85 \times \frac{P_C}{100} \times R \times \frac{C_1 - C_0}{C_0}$
Steel	$V_S = W \times \frac{X_S}{100} \times \frac{SI - SI_0}{SI_0}$	Nil	$V_S = 0.85 \times \frac{P_S}{100} \times R \times \frac{S_1 - S_0}{S_0}$
Materials	$V_M = W \times \frac{X_M}{100} \times \frac{MI - MI_0}{MI_0} \times \frac{CI - CI_0}{\ldots}$	$E_M = (V_{M2} - V_{M1}) \times \frac{W_1 - W_0}{W_0}$	$V_M = 0.85 \times \frac{P_M}{100} \times R \times \frac{M_1 - M_0}{M_0}$
Plant & Machinery Spares	Nil	Nil	$V_s = 0.85 \times \frac{P_P}{100} \times R \times \frac{P_1 - P_0}{P_0}$
Petrol, Oil & Lubricants (POL)	$V_F = W \times \frac{Z}{100} \times \frac{FI - FI_0}{FI_0}$	$E_P = \left(\frac{K_P}{100} \times V_{G1}\right) \times \frac{F_1 \times F_0}{F_0}$	$V_s = 0.85 \times \frac{P_f}{100} \times R \times \frac{F_1 - F_0}{F_0}$
Labour	$V_L = W \times \frac{Y}{100} \times \frac{LI - LI_0}{LI_0}$	$E_L = \left(\frac{K_L}{100} \times V_{G1}\right) \times \frac{L_1 \times L_0}{L_0}$	$V_L = 0.85 \times \frac{P_L}{100} \times R \times \frac{L_1 - L_0}{L_0}$
Bitumen	Nil	Nil	$V_P = 0.85 \times \frac{P_b}{100} \times R \times \frac{B_1 - B_0}{B_0}$

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VI. CAUSES OF COST ESCALATION

Cost escalation can have a serious impact on a company's competitiveness and profitability. Cost escalation during a new product development project, for example, can impact the successful launch of the product. Cost escalation in the supply chain for an existing product forces a manufacturer to either raise prices and lose competitive advantage or reduce the profit margin to maintain price levels.

Reasons for cost escalation

1. Management: Poor cost management is an underlying cause of cost escalation. Cost estimates based on incomplete or inaccurate information may lead to cost escalation during a project or production run.

2. Materials: Raw material costs can rise because of shortage of supplies, excessive demand or a lack of alternatives. A raw material such as coal or natural gas may be in short supply because of production or extraction problems. Natural disasters or climate changes can create supply shortages of materials such as food or timber.

3. Labor: Labor costs have a significant impact on manufacturing costs, particularly in companies where the production process is labor intensive. A rise in wages or employee benefits, additional training costs or an increase in the size of the workforce can lead to cost escalation. Although labor costs remain constant, lower productivity reduces output per employee, leading to an overall increase in production costs.

4. Supply Chain: Changes in the supply chain can have an adverse effect on costs. If a company has to source its raw materials or components from another country, the additional cost of transport and import duties will escalate costs. Rising labor or production costs in the supply chain will also affect the cost of the finished product.

5. Workforce: you can't expand overseas unless you have access to a suitably skilled workforce. This presents problems for firms dealing with advanced technologies or specialized fields. In the absence of an adequate local workforce, you may have to spend a lot of money to recruit workers from other countries. On the other end of the spectrum, many global firms locate production facilities in less-developed nations because labor costs are low.

6. Currency exchange: Currencies in developing nations are particularly prone to major fluctuations. When the dollar rises in value, a firm's overseas labor and production costs decrease. The opposite happens when the dollar drops in value. If the dollar dropped dramatically against Asian or African currencies, the cost of producing goods overseas may exceed the cost of producing goods in the U.S. This makes long-term planning and budgeting particularly challenging.

7. Energy costs- As with currencies, energy prices are prone to volatility. Rising energy costs could cause a firm to look for different ways to ship goods. For example, it may cost less to ship by sea rather than by air. However, such a change also affects the amount of time it takes to move goods around the globe. This could also negatively impact the company's bottom line.

VII. IMPACT OF COST ESCALATION DUE TO COVID-19 ON CONSTRUCTION WORK

The infectious disease COVID-19 caused by a newly discovered virus and that is Coronavirus. The first transmission of coronavirus from animal to human was in Wuhan, China in December 2019. Since then it has spread rapidly all over the globe through person to person contact. The World Health Organization declared the COVID-19 as pandemic on 11th March 2020. Like other nations, the Government of India also imposed a lockdown from 25th March 2020 to control the epidemic. There was a strict restriction on the movement of people and gatherings. However, due to the restrictions placed by the Government all the construction activity and most of the business activity has halted across the country. In this situation, the consequences like reverse migration, disruption of the supply chain, and others make the hindrance to meet the obligations under the construction and engineering contracts.

Following are the impacts of COVID-19 on construction work

1. Material Shortages
2. Labour Shortages
3. Changing Safety Requirements
4. Transportation Problem
5. Financial Problem
6. Contractual Implication Problems
7. Unemployment

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VIII. MEASURES TO MANAGE COST ESCALATION RISK

1. Estimating Assumptions: Historical data related to cost or durations that worked just a year ago are hopelessly outdated now, due to supply chain issues, labour costs and availability, and COVID 19 protocols. Builders should pay special attention to improving the accuracy of this information continuously. Escalation is more likely if your underlying assumptions result in an insufficient budget or schedule.
2. Phased Bidding: To remove some exposure to escalation, consider identifying high risk scopes, educating owners on the risk, collaborating to get the related design early, and expediting buying these scopes to lock in pricing as early as possible. Focused, phased bidding may eliminate the need to wait for complete documents for all scopes prior to procurement. The downside is that later scopes are more exposed to escalation if the overall procurement timeframe stretches out, so approach this with the big picture in mind.
3. Scheduling Considerations: The construction schedules you commit to are a key to escalation risks that will be encountered. Builders should examine their schedules for areas where escalation risks can be mitigated. This could entail accelerating some or all of the project to reduce the duration and limit exposure to forces contributing to escalation. It could also entail building additional time into the schedule or increasing float to allow for a more reliable or cost effective supply chain or subcontractor to be used. Time truly may be money in this situation.
4. Materials Pre-purchase and Storage: Builders have options related to the procurement of materials and a strategic delivery/storage plan may reduce escalation risk. Builders may facilitate this via payment for stored materials. Related challenges must be considered: cost, contract, insurance and a variety of logistical implications.
5. Contract Updates: While it is typical to include an escalation clause in subcontracts, consult with your advisors about including force majeure, material escalation clauses, and equitable adjustments in owner contracts to address escalation. In addition to some protection, this may lead to a more collaborative project environment. When all parties share the risk, all parties have an incentive to work together to manage it.

IX. CONCLUSION

COVID-19 has done a lot of damage to society. It has affected the society as well as our Indian economy. The major parameters that influence the cost escalation are steel, cement, aggregates, bricks, equipment and labor costs. Contractors should be transparent in the cost escalation claims process to avoid formal dispute with owners. Owners should also stand vigilant in drafting and understanding their contractual rights to evaluate a contractor's claim for cost escalation. Effective implementation of remedial measures can bring down huge economic loss to the nation.

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