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COST ESCALATION OF RESIDENTIAL BUILDINGS DUE TO COVID – 19

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ABSTRACT
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 in construction project refers to anticipated increase in cost of constructing a project over a period. 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. Escalation is usually calculated by examining the changes in price index measures for a good or service. In cost engineering and project management usage, escalation and cost contingency are both considered risk funds that should be included in project estimates and budgets. 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. In this paper we studied what factors affect cost escalation, various methods which are used to calculate cost escalation as well as how COVID-19 has affected construction industry as well as residential construction sector.

Keywords:
Construction Projects, Schedule Overruns, Project Costs, Cost Overrun, Cost Escalation, Price Index, Cost Contingency, COVID-19, Construction Industry, Residential Construction Sector.

1. INTRODUCTION

Construction Industry is the backbone of our economy. But being an unorganized sector is always being surrounded by various problems relating to quality, contract administration safety. 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. In the construction industry Cost and time are the two major factors that are considered in construction project. When there is delay in any activity, the cost of construction is affected. The project is said to be successful when it is completed in desired time and cost. The construction delays are the major problems in public and private projects. This problem frequently occurs in the life time of the construction projects that may cause cost overrun of the planned cost.
Cost escalation and schedule overruns can occur due to a wide range of causes on various types of projects. If project costs or schedules exceed their planned targets, client satisfaction would be compromised. The funding profile would no longer match the budget requirement and further slippage in schedule could result. On the other hand, if the project quality does not meet design standards, the client's satisfaction would be compromised. 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. If there is an unexpected rise in the market prices of key construction materials, a contractor will have no respite from such increases. It is necessary to have an escalation clause in the contract to

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guard against a sudden spurt in the cost of materials. On the other hand, if the contractor does not allow for inflation and interest rate correctly, his initial tender would be too low and he would suffer significant losses.
Cost Escalation associated with government construction projects differ according to the country and the specific sector in which they are implemented.

2. OBJECTIVE

- To understand the concept of cost escalation.
- To study escalation clauses presently used in construction work adopted by various government/ department agencies in India.
- To prepare a data regarding price variation in construction commodities that may help estimators.
- To give suggestion those can be used to overcome the problem of price variation in current escalation system in building construction.

3. LITERATURE REVIEW

1. Minsoo Choi, Jinu Kim & Moohan Kim in their paper “A Study on the Price Escalation System in a Construction Contract”, explains that price escalation in a construction contract can be improved by following the policy Delphi technique. The study is done with keeping Korean policies as the mainstay but comparisons have also been made in various aspects with other countries/regions (USA, Japan, Philippines and nations following Fidic). Policy Delphi technique included two questionnaires followed by group discussions with 14 experts. Results of the Delphi showed that minimum fluctuation rate for price escalation was desirable at a level of 3%. Losses caused by price change should be shared between contractor and owner; therefore, a deduction rate should be introduced in contract price escalation. Meanwhile, overhead and profit should be adjusted in proportion to the fluctuation rate; but advance payment or the delayed construction should be deducted from adjusted amount. Thus the paper suggests ways in which various improvements can be made in escalation clause in construction contracts.
2. S. Shanmugapriya & Dr. K. Subramanian in their study "Investigation of Significant Factors Influencing Time and Cost Overruns in Indian Construction Projects”, This research work was carried out on studying significant factors causing Time overruns and Cost overruns in Indian construction projects. A valid questionnaire for the survey was developed based on factors for time overruns and factors for cost overruns identified from literature review. These factors were grouped into 12 categories for time overruns and 8 categories for cost overruns and distributed to Contractors, Consultants, and Owners of Indian Construction Industry. The data from the questionnaire was analysed statistically. Relative important index method was used to found out the most significant factors affecting Time and Cost overruns. It was found that five most significant factors causing time and cost overruns in Indian construction are material market rate, contract modification, high level of quality requirement, project location, depends on the fresher’s to bear the whole responsibility for time overruns and high transportation cost, change in material specification, escalation of material price, frequent breakdown of construction plants and equipment’s, and rework for cost overruns. So this implies that a need of urgent attention is to be put on these factors to avoid time and cost overruns.
3. K. Vamsidhar, D. A. Eshwarswaroop, K. Ayyappapreamkrishna & R. Gopinath in their work "Study and Rate Analysis of Escalation in Construction Industry", compared the cost of construction such as building materials, labours and equipment for past six years from the year 2008 to 2013. It is found that steel, cement, bricks, composite materials, equipment, labours found to be critical parameters in increasing the project cost, cost of the construction has increased during 2008-2009, 2009 -20010, 2010-2011, 2011-2012, 2012-2013 by 10.61%, 9.00%, 13.21%, 13.26%, 10.24% respectively. Increase in labour component by 140% during 2008-2013 years, forecasted price for years 2013-2014, 2014-2015, 2015-2016 is 11.85%, 11.85% and 11.94% respectively.

4. Prof. Yogini Patil & Prof. Pankaj P. Bhangale in their work "Investigation of Factors Influencing Cost Overrun in High-Rise Building Constructions", investigated the factors influencing Cost overruns in Indian construction projects. A valid questionnaire for the survey was developed based on factors for cost overruns identified from literature review. These factors were grouped into 8 categories for cost overruns and distributed to Contractors, Consultants, and Owners of high-rise construction projects. It is found that high transportation cost, change in material specification, increase in material cost, frequent breakdown of construction plant and equipment and rework are leading to cost overrun in a high-rise construction.
5. Yaseer Elfahham in his study "Estimation and prediction of construction cost index using neural networks, time series and regression", it is expressed that the authors have experienced there was no authorized agency for declaring the index in Egypt, to overcome this challenge construction cost index (CCI) has been utilized, Construction cost index (CCI) is an index that provides the fluctuations in construction costs. This is beneficial in evaluating, pricing and bidding construction projects, especially with the high rates of Inflation occurs in Egypt. And study was restricted to concrete structures only, the data was sourced from "Central Agency for Public Mobilization and Statistics" of Egypt, the derived weightage of steel, cement, sand, aggregate and bricks are of 54%, 30%, 10%, and 6% respectively. The CCI has calculated for the study period of 2002 -2018 considering that base year as 2010. Neural network, Linear Regression and autoregressive time series methods were used to predict the construction cost index. The performance of the three forecasting methods was then evaluated using the mean squared errors and the mean absolute errors approaches. It was found that the prediction using Autoregressive Time Series was found to be the most accurate method, as it produced the least average of absolute errors of 3.5, while Regression method was less effective with average of absolute errors of 17.5, besides, Linear Regression Method provides linear prediction which is not practical.
6. Soumi Majumder & Debasish Biswas in their paper “COVID-19 Impacts Construction Industry: Now, then and Future”, explains how COVID 19 has affected the construction industry. The current and lasting impact of the COVID-19 pandemic has been created a whole new set of risks for every construction project in India. It is the responsibility of the owners and contractors to identify and manage the risk with this changing scenario of the city due to this epidemic. The COVID-19 outbreak will surely change company policies, work culture and also increase the use of automatic machines in the construction sector. The clients will surely shift from the real estate industry to various diversified industries like e-commerce, Artificial Intelligence (AI) automation, logistics etc. AI will take a significant role in global construction market analysis (competitive landscape and detailed information on vendors), revenue, and forecasting (component, service model, and development model, vertical and geographical analysis) and growth. AI will also take an important role to predict cost overrun of a project (based on size, type of contract, competency level of risk mitigation, automation). Moreover, upcoming trends and changes in customer behaviors can also be predicted by AI. Besides these, the use of cloud computing will help in mobility and allow users to access relevant records and real-time monitoring. Companies may opt for contextual and/or scripted (or hybrid) chat bots to save time and money. Unmanned Aerial Vehicle (UAV) drone supported with artificial intelligence will monitor construction sites. It is expecting that the use of prefabricated construction, 3D printing (additive manufacturing), use of augmented reality/virtualization, use of big data and analytics, use of wireless monitoring and connected equipment, 3D Scanning, photogrammetry etc. will significantly increase in this industry.

4. COST ESCALATION

The implementation period of the construction project is single year and multi years. Single year construction project is a project activity whose implementation period is less than or equal to one year (twelve months). Meanwhile, multi-years’ construction project is a project with the period of more than one year. Multi-years projects certainly have a lot of risk in the implementation process. One of the risks in multi-years’ projects is price adjustment or commonly called as cost escalation. Cost escalation is the adjustment of unit price of contract component which includes labour, construction materials, energy and equipment to contract value during bid. The

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cost of completing the construction is made up of the volume of work based on the drawing and job specification and the unit price of the work obtained from the unit price analysis. In practice, the unit price of the work must be accordance with the specifications set in both drawing and requirement and considering the technical conditions of the field at the project site to obtain accurate estimation result. The cost of a construction project is definitely also influenced by its implementation period, especially multi-years' projects. The intensity of construction project activities changes throughout the project. This is certainly become a particular concern for multi-years' projects. Multi-years project with duration of more than one year will potentially have risks in the execution period, not only from economic fluctuations that affect cost escalation but also from some other things like bad weather, changes in the scope of work, job delays, labour strike, and technical issues (image, specification, and contract changes). The situation as mentioned above will greatly affect the implementation period and project cost if it is not anticipated, especially on the problem of economic fluctuations that affect cost escalation. The cost of the project is influenced by many factors and the factors are related to each other/dependent. Project cost will also change over time, which means the likelihood of changing costs is affected by the passage of time. As time goes by, these factors change as well, as a result the cost also changes.

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.

4.1 Causes of Escalation

In general, construction projects are usually of quite lengthy ranging from several months to several years. Also, such construction projects are performed according to a pre-confirmed contract amount and contract agreement in principle. Therefore, there is a strong probability that the cost of labour and materials will rise and fall periodically, to a greater or lesser extent, during the life of the project.

Following are the common causes of Escalation in construction projects:

i. Land acquisition costs
ii. Change in the project scope
iii. Monopolistic pricing of vendors in case of special resources
iv. General price rise
v. Underestimation of original cost
vi. Changes of rates in foreign exchange
vii. High cost of environmental safeguard
viii. Lack of infrastructure support and linkages
ix. Delay in tie ups for projects financing
x. Delay in finalizing detailed engineering
xi. Delay in finalizing tendering, orders and supply
xii. Law and order statutes of regional states
xiii. Geological surprises
xiv. Market conditions depending upon inflation
xv. Risk allocation among the two parties
xvi. Tax structure of Central government

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5. COVID - 19 AND ITS IMPACT ON CONSTRUCTION SECTOR

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. As the novel Coronavirus was continuously spreading and there was no vaccine or control mechanism many countries like China, France, Italy, Poland, New Zealand, UK, and others took the action of most restrictive mass quarantines. When it came to India, the same decision of lockdown had been made by the Government of India. Due to this lockdown situation, almost every commercial activity is suffering the effects of ruthless COVID-19. In this pandemic, the hardest affected sector is the construction and engineering sector. Already the industry faced multiple challenges such as lack of capital, multiple regulatory burdens under the Environment Laws and Real Estate (Regulation and Development) Act,2016 and now it is merged with COVID-19 pandemic. 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.

5.1 Material Shortages

The emergence of COVID-19 in early 2020 led to worldwide shutdowns, and many manufacturers did not immediately reopen when restrictions began to ease. As manufacturers began reopening, they faced unprecedented labour and raw materials shortages, which created production delays and further drove costs up. When construction was deemed essential construction projects worldwide were re-started and often fast-tracked, those shortages and delays became even more apparent, as suppliers struggled to keep up with rising demand.

The initial spike in prices on some building materials such as wood, steel and copper, occurred in July of 2020, and continued their surge through May of 2021. However, demand continues to remain largely unaffected, which solidifies the need for contractors and owners to take into account the impacts from these shortages, *e.g.* on budget and scheduling, plan carefully in advance for capital projects from the initial bid, drafting of contract language, and through project execution.

The party procuring the materials (*i.e.* a general contractor, subcontractor, or supplier) usually bears the risks of material price escalations, at least in fixed-price contracts and guaranteed-maximum-price ("GMP") contracts, unless a price escalation is caused by a condition that is otherwise addressed in the contract.

5.2 Labour Shortages

In recent years, shortages in skilled labour have been a nagging concern in the construction industry and COVID-19 has exacerbated these shortages. Shutdowns, illness and concerns over health and safety kept many skilled workers at home, and those that continued working were forced to institute time-consuming safety protocols that slowed their productivity. Now, as projects and related manufacturing and other supply-chain operations previously stalled during COVID-19 are jump-started, labour shortages continue to deepen.

Wage escalation may be recoverable, if the Contractor is required to pay its labourers at a rate higher than anticipated due to delays, changes, or other acts of the owner that push performance of the contract into a higher wage period. However, contractors typically bear the risk of escalated wages during the original period of contract performance.

5.3 Changing Safety Requirements

In addition to direct Material and Labour shortages, COVID-19 safety requirements have an impact on the cost of materials and labour. For instance, hand washing stations, employee temperature checks, loss of productivity for changes to manufacturing layout, and increased absences due to illness all drive increased costs.

4.4 Supply Chain Management

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The supply chain has been disrupted in various ways in different parts of the world. Various construction materials are required but for lockdown these are not reaching the construction site from outside which is hampering the construction work. The various materials that come from different factories in the country or abroad through different vehicles for construction work, those things cannot come. All vehicles are not able to come to lockdown due to which the required materials are not arriving so the work is off. It has not only shut down the construction industry, it has also damaged the livelihoods of those who bring these things in vehicles and the factories that make all these materials are also losing a lot of money because these are not being sold.

5.4 Transportation Problem

All transportations in the country have been disrupted due to lockdown in all parts of the country. That's why no materials are arriving in the construction sector and no workers are able to come to work from their home. That's why the work has stopped.

5.5 Financial Problem

The companies are not making any kind of profit due to work stoppage in the companies and on the contrary more losses are being incurred and not only the company is losing money but also all the suppliers who are providing the required materials to different companies to be used in construction sector, all those suppliers are also incurring huge losses. Since the closure of the company, the supply chain has been shut down and the factories that produce goods have stopped production, resulting in many losses of them. Moreover, due to non-sale of factory-produced goods and closure of the construction sector, the government is unable to collect proper taxes from all these places which is having a direct impact on the country's GDP and when the country's GDP goes down, it affects the global economy.

5.6 Contractual Implication Problems

It is mainly based on a clause called 'Force majeure'. There are many rules mentioned in this clause, 'Large Scale Epidemic' is one of them. COVID-19 pandemic falls within this category. Different contractors put their different tools in different places for use in different machinery construction sector but as a result of this lockdown, all this equipment have been lying there for a long time. The companies have a contract with the contractors to work with all this equipment on the basis of some money and If the 'Force Majeure' Clause is mentioned in the contract then no compensation will be paid to the contractor by the agency due to delay. The result is a lot of financial loss when contractors stop working.

5.7 Unemployment

Companies are suffering huge economic losses due to this lockdown. That is why companies are not able to pay their employees properly and the company is laying off a lot of workers. Due to this, many people's jobs have been snatched away. Their families are also going through a lot of hardships as a result of losing their jobs.

6. HOW COVID 19 HAS IMPACTED RESIDENTIAL CONSTRUCTION

Residential areas are typically classified as providing varying amounts of living accommodation for people. Residential areas are usually designated as such by the development plan of the authorities of a city or municipality, including the amount of units and, consequently, the approximate number of people living in that area following the prescribed density. The amount of land zoned for residential development should be in line with the projected population growth figures, as set out in regional strategic development documents (such as Regional Planning Guidelines).

Residential areas will generally consist of various accommodation types: apartment schemes (medium to high density), detached or semidetached houses (low to medium density), or terraced housing (medium to high density). The character of a residential area can be influenced heavily by the mixture of tenures (owner occupier,

private rental, social housing) which are available within an area. Residential building is a multi-residential space contained in a single structure where dwellers may rent or own their residences.

Globally, construction is more than USD 11 trillion industry, of which residential construction is the largest sector. The occurrence of COVID-19 has caused disruption in the residential construction sector. The main disruption is in the supply chain. The transformation of COVID-19 from a China-centric challenge to a global pandemic has resulted in shifting the impact to the global construction supply chains and markets.

The ongoing pandemic has created a number of challenges not only for the construction industry but also disrupted the global economy. The global crisis, duration of the recession, and path of recovery will largely determine the nature and severity of these challenges.

7. METHODOLOGY

In this project, cost escalation sheet will be prepared. Data will be collected from various residential sites. 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. Using all this data, excel sheet will be filled. A comparison will be made for the prices before COVID-19 and post COVID-19.

8. REMEDIAL MEASURES

i. **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.

ii. **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.

iii. **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.

iv. **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.

v. **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.

9. CONCLUSION

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. And, legal and consulting professionals with the relevant skills, knowledge and experience can assist contractors and owners in evaluating and resolving cost escalation claims.

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The major parameters that influence the cost escalation in construction industry are steel, cement, aggregates, bricks, equipment and labor costs are found. Huge amount of money and the cost overrun of infrastructure projects over time lead to a great economical loss. Effective implementation of remedial measures can bring down huge economic loss to the nation.

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