A Review of India Centric Studies on Factors Causing Time Overruns in Execution of Construction Projects

Dr. Swapnil Wanjari[1] Bhalchandra Tankkar[2]
[1]Assistant Professor [2]Student of M. Tech (Construction Technology & Management)
[1,2]Department of Civil Engineering
[1,2]V.N.I.T. Nagpur, Maharashtra

Abstract— The construction project process can be divided into three main stages, i.e. project conception stage, project design stage and project construction stage. Generally, most of the project delays take place during the actual construction period, where many unanticipated factors are constantly implicated. In construction, delay may be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for the delivery of a project. There number of construction projects facing widespread delays has increased resulting into excess expenditure and consequent loss of other resources. The intention of this study is to review and identify the applicability of past studies on determining the factors causing time overrun in ongoing construction projects. This paper examines seven India centric studies which have surveyed the delay factors and classified them into groups or categories, done by various researches and agencies in the past decade. The focal point of this paper is to review research which has categorized the causes responsible for time overruns in projects. This review paper attempts to give a restructured compilation of the earlier studies on ranking of the factors causing time overruns, which though not similar, have certain recurrent factors emerging in nearly all the studies thereby indicating the need to address them by devising mitigation measures.

Key words: time overruns, delays, construction project, India

I. INTRODUCTION

Infrastructure plays a superlative role in the economic development of a country. The annual spending on infrastructure in India has been rising on an unswerving basis. In each five year plan, the government lays down a motivated objective of undergoing an economic growth which is higher than the previous one. India has laid down a target of investing 5574663 crores in infrastructure during the Twelfth Five Year Plan period 2012-2017 as compared to 2424277 crores in the Eleventh Five Year Plan [1]. This commitment underlines that infrastructure development has been a key focal point in every Indian state more so in the recent past. Mammoth finances had been assigned for infrastructure development in every Five Year plan at the Center as well; still, the country has time and again failed to meet such targets over the last few years. It is a well-known reality that numerous infrastructure projects in India have been delayed and suffer from time overruns. A report by McKinsey estimates that India could suffer a GDP loss of USD 200 billion in fiscal year 2017 if the same trends continue [2]. Given the decisive role of infrastructure in guaranteeing an unrelenting growth trajectory for India, it is of the essence that we recognize the core problems upsetting the completion of infrastructure construction projects in India. The aim of this study is to get the theoretical framework that epitomizes the literature available on factors responsible for time overruns in execution of construction projects in India.

II. LITERATURE REVIEW

The theoretical and investigational literature on the subject of time overruns suggests that they are generic to infrastructure projects and are a global phenomenon; India is not an exception. Nonetheless, the literature also divulges that the principal factors affecting construction schedules, and thus the mitigation measures, vary from country to country. This variance in direct applicability of international studies implies and underscores the necessity for a methodical India-based study. Besides international literature has a constrained reference in elucidation of the nature of time overruns observed in India. It is worthy to mention that some works of Indian scholars have given remarkable inputs to supplement the research on identification of significant factors causing time overruns in India. In this paper we review some of the recent studies undertaken and try to establish coherence in the findings obtained.

Iyer and Jha [3] recognized 55 attributes which had a profound impact on the performance of the projects. The importance of these attributes was obtained from Indian construction professionals by means of a questionnaire. The responses were then subjected to statistical analysis and grouped as Success attributes and Failure attributes. In this paper we are concerned mainly with the failure attributes so obtained. These failure analysis were further analyzed using Principal Component Factor Analysis (PCFA) in order to extract attributes with higher variance and were separately grouped seven critical failure factors. These factors included conflicts among project participants, ignorance of the project manager, hostile socio-economic conditions, incompetence of the owner, inability of project participants to take decisions, harsh climatic condition at site and other project specific factors. The conflicts are generally caused due to either difference in opinion or lack of unity of goals between the project parties. The conflicts amongst project parties ruins the team spirit and at times can have serious consequences like splitting up of the team and lack of assistance among the groups. Conflicts are therefore detrimental to the smooth advancement of work and they ultimately delay in wrapping up of all those works that necessitate teamwork and synchronization among the disagreeing groups. The factor Project Manager's ignorance includes various other issues poor technical knowledge, insufficient communication skills and ignorance of planning tools. Such a project manager is not capable to recognize and examine the key activities that have to be carried out for

timely completion. Lack of knowledge of effective procedures will lead to time overrun for the project. It was thus advised to employ a competent project manager since an uninformed and less knowledgeable project manager can affect the schedule a project. Hostile Socioeconomic Environment included intimidating political and economic environment. Incompetency of the owner can result in poorly devised project and there is a possibility that such an owner would set the completion date without correct planning, and also would be unable to employ a competent person to take care of his interests. The resultant is a delay in the planned schedule. The indecisiveness of project parties in taking routine decisions as well as key decisions is detrimental to the schedule performance. Harsh climatic condition at site results in considerable loss of man-days. It not only reduces productivity but also causes issues in mobilization of resources. The project specific factors included uniqueness of projects which might pose certain challenges which weren't faced by the parties before like unexpected site conditions, lack of design, etc.

In 2008 McKinsey & Company [2] carried out a proprietary research on comprehensive infrastructure development of India and prepared a report about the factors affecting delays and causing huge time overruns in infrastructure projects. The prime factors responsible for delays in execution phase, as identified were poor designing, inefficient site execution and a dearth of manpower. The research revealed that the project plans were of lesser value and lacked consideration to details, which produced difficulties like scope modifications and disparity during project implementation, thus resulting in conflicts and delays. Also, government agencies never adopted a value engineering approach to project design which escalated the project costs. The detailed project reports repeatedly suffered from a lack of thought to detail and quality. There was a propensity to bypass technical consultants in areas such as topographical surveys, environmental impact assessment and field investigation. This affected certain special projects resulting in delays. For instance, completion of hydro power projects is dependent on knowledge of geological conditions. Imprecise geological surveys can show the way unexpected site conditions during construction which may compel to have consequent changes in the extent of projects, and re-drawing of plans. This can lead to unimaginable time overruns. The other prominent factor was scarcity of manpower- unskilled, semi-skilled and skilled. It was observed that the increase of skilled and semi-skilled manpower in India was not in proportion to the intensification in infrastructure projects. This can be attributed to the fact that India's vocational education syllabus is mostly obsolete lacks clarity. Further, the existing certification procedure is based principally on conjectural testing, and does not guarantee employability. The report also cited reasons like ambiguous contracts which often resulted in conflicts among project parties due to poor definition of scope. Most organizations use a large number of contracts that are frequently ambiguous and lop-sided. The reported highlighted that clauses in relation to design variations, price escalations, payment of advances and deduction of retention money from running bills are the most arguable and frequently cause disagreements during construction and called for amendments in the framework of existing contracts in order to bring in clarity of scope and eliminate the chances of disputes arising from ambiguous clauses. The report highlighted the need for an adoption of a systematic risk management approach. The Indian contractors used inappropriate tools and had inadequate skills to evaluate and handle risks when compared to contractors in developed countries. McKinsey's assessment of leading construction companies in India revealed a low prevalence of global norms of risk assessment. This increased project costs and caused delays and resulted in project failures when contractors take up projects beyond their capabilities.

Doloi et al. [4] researched the factors causing schedule delays in Indian construction projects. It was found that lack of commitment; poor site coordination, inefficient site management, inappropriate planning, lack of clarity of project scope and lack of communication were the chief causes of time overruns. The probable reasons and underlying issues for each of the above factor can be given as

A. Lack of Commitment:

It is necessary all the parties concerned must commit for timely conclusion of any project. Site accidents because of deficient safety measures are due to lack of commitment of both client and contractor towards the project. Site accidents injure individuals and the productivity of labour decreases extensively after an accident. Time is also lost in attending to accidents and replacing the injured individual by an individual with lesser or unrelated skills. More hard work is required on training and development. These things can be prevented if client and contractor are devoted to apposite safety methods taken up on the site. The second thing is the lack of stimulus for contractor for early completion (i.e. no enticement for early completion) visibly indicates lack of commitment from the client and other concerned parties. Moreover use of inappropriate or outmoded construction techniques is an outcome of unprincipled commitment and conceivably devoid of a pertinent obligation to project from the contractor. Inappropriate construction techniques compromise the quality standards and safety apart from lowering the productivity, which possibly extends the length of the project. Delays in material delivery by supplier exhibit the lack of commitment by contractor's procurement planning done preceding the construction stage of project. Lack of knowledge about the expected time for material delivery by the suppliers consequently results in material scarcity, which has supposedly been one of the major causes of schedule delay in most of the construction projects.

B. Inefficient Site Management

This factor has four underlying issues that need to be resolved. The first issue was vagueness in specifications which likely resulted in contradictory interpretations by the parties and most often culminated in disputes. The second issue is poor labour productivity either due to employing unskilled labour or due to lack of proper supervision over them which come under inefficient management skills of the supervisor onsite. In case there is unavailability of work force with the required skill set and hiring of unskilled labour is inevitable, they must be trained properly before putting them at work. Third issue is lack of control over sub contractor which is a sign of the incompetent management

ability of chief contractor. This possibly links to lack of clear contractual structure and norms for appointing subcontractors in Indian projects. Lack of control over subcontractor may show the way to unnecessary clashes, low output and increase of distrustful feelings on the site. Fourth issue is insufficient experience of contractor which is due to lack of site supervision skills of the client. Inexperienced contractor may not be able to deal with the advancement of work or may not comprehend the complication of project leading to misinterpretation and uncertainty. Inadequate experience of contractor consequently leads to inappropriate management of site and thus causes time overruns.

C. Poor Site Coordination:

Poor site coordination has supposedly been one of the key failure parameter for most Indian projects. First point beneath this factor is non availability of drawing/design on time which is by and large because of lack of coordination between construction site and design office. Non availability of drawings not only makes resources inoperative but also disrupts contractor's momentum. Second point, slow decision from owner is due to lack of proper coordination between client and consultant or client and contractor. This happens when contractor or consultant falls short to make the client comprehend the time significance of decision to be taken or owner's decision is not communicated properly to concerning parties. Third point is the impractical time schedule given in contract owing to lack of coordination between client and contractor about the practical complications at the site. Though impracticable schedule is a reason not only for time overrun but it also forces contractors for compromise quality of construction which results in errors and reworks in construction activities. Fourth point is the poor site administration and regulation which clearly highlights the lack of coordination between various bureaucratic hierarchies involved in Indian construction industry. Efficient site management and effective supervision is one of the vital factors for achieving success in Indian projects.

D. Inappropriate Planning:

Inappropriate planning divulges five basic issues. First issue, severe weather conditions is certainly a concern in Indian conditions. Extreme weather conditions are in commonly ignored during planning stage of construction which leads to inappropriate estimation of labour productivity and thus improper estimate of activity time. It also point towards the lack of emergency measures for severe weather conditions. Second issue is the lack of skilled operators for specialised equipment is a situation caused due to lack of proper equipment planning. In existing situation, skilled labour is believed to be one of the scarcest resources in the context of high volume construction projects in India and thus proper planning of human resources is inevitable across all projects. Third issue is unproductive use of equipment results from untimely mobilisation of equipment leading to idling of resources. This issue also possibly links to non- availability of the skilled operators on the construction site. Fourth issue is poor coordination among parties by and large occurs due to improper flow of information between various parties of construction which occurs due to lack of planning in order of events. Fifth issue is hindrance in material procurement (by contractor) is a result of improper scheduling or lack of understanding of lead time of materials delivery.

E. Lack of Clarity in Project Scope:

Lack of clarity in project scope includes five basic issues. First issue is rework owing to modifications in design. The modifications may arise due to unclear designs and specifications given by the client and poor coordination between the client, designer and engineer. Second issue is the rework by reason of mistakes in execution as it adds to delay since rework itself takes up time and resources. Rework due to errors in execution entails project manager's lack of appreciation of scope or design of the project. In addition, if there are errors in estimation of expenses for carrying out rework, then the excess amount is usually borne by the contractor, which eventually leads to financial difficulties and may demoralize the contractors to complete the project on time. Third issue is award of sub contract to incapable sub-contractors which compels the client to frequently change the sub-contractors owing to their lack of understanding of the project complication and incapacity of the project manager. Fourth issue is the increase in scope of work at further stages caused by ambiguity of project scope by owner and designer. Increase in extent of work at a later stage delays the project completion due to variations in quantities and modifications in project schedule. Increase in scope of work may further delay project because of unavailability of appropriate additional resources with the contractors. Increase in scope of work may also result into exhaustion of the contractor's resources and reduce his capability to follow the time plan. Fifth issue is inappropriate storage of materials resulting into damage which may lead to a shortage of quality materials on site when required. This can be attributed to the non cognizance and negligence by the project manager on proper inventory planning and other relevant material management techniques.

F. Lack of Communication:

Lack of communication has three issues linked with it. The first issue is delays in obtaining requisite permissions from local authorities caused as a result of lack of communication with local authorities. It may be because of delay in application process for obtaining permission or not having a follow up or misapprehension of applied permission by local authorities. Failure to obtain consent from local authorities may not only interrupt the work schedule but can also lead to legal complications which may further contribute to time overruns. Second issue is delay in endorsement of completed work by client (stage passing) which is mainly attributable to lack of communication between contractor and the approval authority. Such a lack of communication can be both ways i.e. either client is uninformed of completed work or order of accepted work is not exchanged with the contractor. Delay in approval of completed work not only causes delay due to disruption of further work, but also hold-up in payment to contractor which in turn causes financial complications. Financial problems of contractors has supposedly been one of the significant reasons of delay in construction projects Third issue is the consultant or architect's unwillingness to change which is due to inappropriate communication of inevitability for change. It

is the duty of the project manager to give explanation to the architect about the practical technical hitches being encountered on site and thus the need for change. Thus second factor stresses on the significance of communication during various phases of construction. The implication of this issue is has not been accounted in past researches and therefore calls for an in-depth study of this aspect.

Venkatesh M.P. et al [5] carried out a study to determine the resource related delay factors in construction projects. The questionnaire formed for the study included a total of twenty eight delay factors grouped under three broad categories viz. Manpower related, Material related and Equipment related. This questionnaire was aimed exclusively for mangers and engineers serving in various organizations involved in construction projects. A total of eighty four professionals participated in the survey. The data so collected was then analysed by computing the Relative Importance Index and the factors were ranked accordingly. The Spearman's rank correlation coefficient was used to determine the degree of agreement between the managers and engineers. There was a considerable agreement between managers and engineers with respect to delay causing factors across all the three categories. In the Manpower related factor category, the top factors were (1) Shortage of labour, (2) Lower skills of available labour and (3) Migration of labour. The top factors in Equipment related category were (1) Non availability of equipment, (2) Complications faced due poor knowledge of use of advanced technology equipment and (3)Delays due to transportation of equipment from one site to other. In the Material related category the major factors causing delays were (1) Shortage of materials, (2) Changes in material specifications by the owner and (3) Slow delivery of materials.

Desai and Bhatt [6] undertook a study to investigate the causes of delay in residential projects in the Central Gujrat region. The study involved preparation of a questionnaire consisting factors shortlisted by researching past studies and by consulting local experts. A total of 59 causes of delays for residential construction projects were identified. These causes were categorised in nine main groups as: Project related, Owner related, Contractor related, Consultant related, Design-related, Material related, Equipment related, Labour related and External factors depending on their nature and mode of occurrence. The respondents were then asked to rate the factors for their frequency and severity. In order to rank the factors two approaches were used. The first approach was to use the Relative Importance Index for the purpose of ranking and the second approach used the product of frequency and severity indices for ranking. The product so obtained in the second approach was termed as Importance index. The results obtained by both the methods were comparable and reflected more or less the same factors. The study thus concluded that the prominent factors responsible for time overruns in residential projects in the Central Gujrat region were (1) Short contract duration; (2) Shortage of labours; (3) Delay in material delivery; (4) Late procurement of materials; (5) Low productivity level of labours; (6) Delay in progress payments by owner; (7) Ineffective planning and scheduling of project by contractor; (8) Difficulties in financing project by contractor; (9) Delays in producing design documents; (10) Poor communication and coordination by contractor with other parties.

Shanmugapriya and Subramanian [7] conducted a similar research to identify the factors causing delays in all types of construction projects. This study too adopted a questionnaire survey approach. The questionnaire used for the study was developed had 76 factors of time overruns divided across 12 major categories viz. Project related, Contractor's responsibility, Subcontractor's responsibility, Consultant's responsibility, Management condition related, Design and documentation related, Economic condition related, Material related, Environmental condition related, Labour and equipment related and Government policy related. The questionnaires were circulated to owners, consultants and contractors of Indian construction industry. A total of 70 response sets were acquired. The data was then tested for its reliability by calculating the value of Cronbach alpha and was found to be reliable. The Relative Importance Index was then computed based on the frequency of responses. A hierarchal appraisal of factors was carried out to establish ranking of the factors based Relative Important Index (RII) value. The dominant factors of construction delays found by this study were (1) lack of commitment, (2) inefficient site management; (3) poor coordination in site, (4) improper planning, (5) lack of clarity in scope of project.

S. Sivakumar et al [8] carried out a study to identify the factors responsible for time overruns in construction projects of Tamil Nadu. The questionnaire survey approach was adopted for this study. A questionnaire comprising of forty factors grouped in five major categories viz. Consultant Related Factors, Contractor Related Factors, Labour Related Factors, Material Related Factors and Equipment Related Factors was prepared and was circulated amongst engineers from both the private and public sector. The data so obtained was analyzed and the factors were ranked based on the Relative Importance Index. It was observed that a general agreement prevailed between both the sectors regarding causes of time overruns. The top factors as agreed upon by engineers from both private and public sector were (1) Poor communication and coordination with other parties, (2) Poor site management and supervision, (3) Late in reviewing and approving design documents, (4) Conflicts between consultant and design engineer, (5) Shortage of labours, (6) Poor quality of construction materials, (7) Shortage of construction materials, (8) Incompetent project team, (9) Rework due to errors and (10) Equipment allocation problems.

III. Discussion

As pointed out by Ram Singh [9], there exists a large body of theoretical and empirical literature on the subject of factors responsible for time overruns in execution of construction projects. It can be said that delays are generic to all construction projects and are a global phenomenon and India is not an exception. However, the literature also divulges that the underlying causes, and thus the mitigation measures, differ from region to region and change with respect to time and other external factors like government policies, market conditions and socio-economic conditions. However it is noteworthy to mention that certain factors feature in nearly all the studies undertaken so far and therefore highlight the need to find appropriate mitigation

measures in order to overcome them. The top ten most critical factors identified from the literature survey which need immediate attention may be given as follows.

1) Shortage of human resources- skilled, semi-skilled and unskilled
2) Inadequate experience of the contractor
3) Poor site management and supervision by the contractor
4) Rework due to frequent design changes or mistakes in construction
5) Unrealistic project duration given by the client
6) Delay in handing over the site to the contractor
7) Delay in financing and payment of running bills
8) Lack of co-ordination or communication between the parties.
9) Problems due to bad weather conditions
10) Shortage of materials on site

IV. Conclusion

For many years, the problem of delay in Indian construction projects has been detrimental. Its impacts are so significant that it tends to decelerate the accomplishment of developmental plans. The mitigation measures for delay factors are not only limited to technical advancements, but also call for improvisation in project management techniques and adoption of forward thinking perspective both from the aspect of processes involved and the influence of human attitudes, behavior and skills. The results and conclusions are applicable to all infrastructure projects, regardless of the sector and the project type. However, generalization has its own disadvantages. Apart from the issues discussed here, there are sector-specific issues also that impinge on delays and cost overruns. Most studies have ignored such issues. For a better understanding of the causes behind time overruns, it will be useful to augment this work with sector-specific analysis as sector-specific studies may allow for testing of additional hypotheses.

References

[1] Central Statistics Office, Ministry Of Statistics and Programme Implementation, Government of India, New Delhi (2014) "Infrastructure Statistics -2014 (Third Issue, Vol. I)" p 32
[2] McKinsey and Company (2009), "Building India-Accelerating Infrastructure Projects"
[3] Iyer, K.C. and Jha, K.N. (2006), "Critical Factors Affecting Schedule Performance: Evidence from Indian Construction Projects," ASCE Journal of Construction Engineering and Management Vol.132, pp 871–881.
[4] Doloi, H., Sawhney, A., Iyer, K.C. and Rentala, S. (2012), "Analyzing factors affecting delays in Indian construction projects," International Journal of Project Management Vol. 30, pp 479–489.
[5] Venkatesh, M.P., Umarani, C., Renuga, S.M. and Malathi, B. (2012), "Analysis and identification of critical factors of delay in construction projects," NICMAR Journal of Construction Management Vol. 27, pp 83-91.
[6] Desai, M. and Bhatt, R. (2013) "Critical Causes of Delay in Residential Construction Projects : Case Study of Central Gujarat Region of India," International Journal of Engineering Trends and Technology Vol. 4 Issue 4, pp 762–768.
[7] Shanmugapriya, S.and Subramanian, K. (2013) "Investigation of Significant Factors Influencing Time and Cost Overruns in Indian Construction Projects," International Journal of Emerging Technology and Advanced Engineering Vol. 3, Issue 10, pp 734–740.
[8] Sivakumar, S., Shree Nath,A. and Sivagamasundari, R. (2015) "A Statistical Study on Critical Factors Influencing Time Overruns in Tamil Nadu Construction Projects," International Journal of Engineering and Technical Research Vol. 3, Issue 1, pp 88–91.
[9] Singh, R. (2010) "Delays and Cost Overruns in Infrastructure Projects : Extent, Causes and Remedies" Economics and Political Weekly Vol. 45, Issue 21, pp 43–54.

