Implementation Of Factors Affecting On Execution Work In Construction Management By RII Method

Asst.Prof. Mamata B Rajgor[1], Hardik Kaklotar[2]
Faculty of Civil Engineering Department Civil Engineering Department, Parul Institute of Technology,
Student of MTech (Construction Project Management) 2nd Year, Parul Institute of Technology, Parul University, Vadodara, Gujarat.

Abstract:
In India, the construction sector is second only to agriculture in terms of size. Construction management is a methodical approach to completing various operations and tasks within a project by coordinating the use of specialised equipment and personnel. There have been tremendous analysis and researches are done at the construction planning, scheduling and risk mitigation level, but as we endeavour to analyze for tools and techniques actually implemented at the execution level of the construction projects which can results the projects to complete as per planned and scheduled limits. This paper aims to identify and evaluate the tools and techniques petitioned for construction management at the level of project execution. To analyze the conflict by literature survey and further analytical questionary review technique identified the concluded outcome to work on the mentality and system changing environment of firms at the execution level strategies.

Keywords: Construction execution strategies, prevent construction conflicts, Planning and scheduling, Construction management, tools and techniques.
DOI: 10.24297/j.cims.2023.04.5

1. Introduction

India is a developing nation. In India, construction is the country's second-biggest economic sector, behind agriculture. Although the economy has been expanding in recent years, the construction industry's expansion has not been contended. Numerous researchers have identified construction industry characteristics that are distinct from those of other industries. For example – field initiated, extremely traditionalist, technologically immobile, etc. But a closer look at construction technology shows that these are only some of the ways in which the different qualities of built products and the limitations of construction technology lead to different results. A key part of making the construction industry more technologically

competitive is for people to learn more about the important features of built stuffs and how these features affect construction technology and its capability to improve. The Construction Industry includes services for building, changing, re-building, and fixing up different kinds of structures. For success of every project time and cost are very important parameters. The goal of construction management is to complete a project within the allowed time frame and financial constraints. The total cost of a project goes up when it takes longer to finish.

Productivity is a broad phrase for describing how efficiently a system converts input into output. To enhance the performance of the construction activities, digital skills are important. The project environment is extremely complicated, and it is inconceivable that decisions could be made without software tools. The software tools enable the application of concepts and the visualization of issues and solutions. Some of the mathematical tools for construction management includes CPM (Critical Path Method), PERT (Program Evaluation Review Technique), Bar chart, Pie-charts etc. The software tools include Primavera, Microsoft Project etc. Some web-based packages, WPMS (Web-based Project Management System) like PM-ASPs (Project Management System-Application Service Provider) are also there.

This paper explains that the currently use of these methods at execution level in the building construction management. Generally, these types of tools and techniques are used at large organizations level only. In building and medium project level there are the organizations which are utilizing only on bar chart method and also at the level of planning. From literatures its concluded that the mentality behind that is the traditional management system- rigid to change the organization management system, lake of trained team, manual management system, due to bar chart system no records of total work done or completion of different activities, etc. The Indian construction sector has had trouble with performance concerns. Problems may be categorised as either those relating to the construction workforce or those relating to the construction planning process as a whole or both.

There are four primary sections to this review. In the literature review portion, it is first described that the researcher’ s analytical views are at the planning, scheduling and risk mitigation level only. The methodology section of this study has since detailed the methodologies and approaches employed in it. As the main strategy for gathering data for this study, a structured, closed-ended questionnaire survey was used. This section also includes Relative importance

index of each related tasks affects to construction time and cost overrun. The discussion of the major findings is then followed by the study's conclusion.

2. Literature Review

The major issues with construction projects in underdeveloped nations is construction execution methods because so many tasks are done by manual methods. The 3M principle, which stands for "manpower, machine, and material," is used in construction. But at the construction execution management level there are too many metrics are inter-related as – execution method, quality criteria, reporting systems, activity performance checklists, labour and equipment safety, etc. There are five main elements that influence Construction productivity: activity performance supervision, skilled worker, tools and equipment, Approvals, and monetary constraints. Due to the wide variety of spoken languages in Indian projects, effective communication is crucial. Practitioners in the Indian construction sector have not yet made any serious effort to address the persistent problem of project delays. There has not been a widespread recognition of the necessity to take a systematic approach to managing construction, therefore in the past, Indian projects have relied on a more ad hoc method of management. The globe saw this firsthand during the final stages of recently completed programmes and initiatives. (Hemanta Doloi 2011)

There are many superiorities to increase in execution process in a building construction. From the owner's and contractor' s perspective, some immediate advantages of increased productivity include lower costs, shorter project durations, and better returns on investment. However, the Indian construction sector falls into the owner-controlled or price-based quadrant from the contractor's point of view. Because of the limitations of a price-based system, a seasoned provider may be compelled to settle for subpar results. (Syed Nihas 2013)

Construction delays are also predominantly caused by low Execution productivity. After design amendments, poor activity performance was the second most common and significant cause of construction delays. according to research by Sowmya Narayanan (2018) found a significant negative association between execution productivity and project success based on a study of 30 completed public construction mega infrastructural projects. To investigate the relationship between project success metrics and the availability of inventories at the execution stage of projects. (Michal Gluszak 2015)

They found a contrary correlation between planning and scheduling level of project and the difficulty in executing the activities and tasks with different frameworks. It is suggesting that productivity deplete as it becomes more difficult to execute the group of activities with team which are working as conventional methods. The researchers (Vahid Shahhosseini 2017) also discovered a robust relationship between the risk of time and cost overruns as per the contract agreement document and the difficulty in arranging the skilled workers, Trained engineers, related equipments and machineries, on time material availability, Related tasks and checklists, etc. with respect to planning and scheduling management of construction projects.

The practises and responses to risks through contracts provided by companies are evaluated in a great deal of additional literature; for instance, some contracts provide projects with all solutions to eliminate the possibility of risk; such contracts are typically expensive; and there are companies that place the transfer and removal of risks during the project period; however, these companies tend to be less experienced. The analysis of other projects revealed a lack of quality and creativity in the transfer and removal of risks, leading to delays in the project period and low quality, so these mistakes should be avoided in other projects by putting workers with experience in dealing with risks, but there are few skilled workers at high cost and high turnover. Because of this, most businesses settle with hiring less qualified employees. (Fatemeh Nouban 2020). Which indicates that mentality of the builders and contractors is less inceptive monetary which later on results in substantial maintenance costs and time overrun of building construction projects.

Following are the critical attributes of construction projects with significant variables using RII > 0.9, the radicle causes of dominant Execution productivity were identified using Relative importance index technique, namely – effective monitoring, coordinating ability of construction executor, feedback criteria by project team, technical capability of project team, operation understanding of engineer at execution (K.C. Iyer 2005). According to studies of the efficiency with which the Indian construction industry completes projects, the "commitment of the project participants" is the single most important factor in meeting deadlines when performance levels are low but takes on less significance when they are high. In cases when the performance rating is already high, it has been shown that the "owner's competence" contributes more to further improving the performance. This feature identifies the value adding factors to the schedule performance and recommends that the project manager very clearly assess the actual

performance and try to concentrate on only value adding factors to improve the schedule performance rather than wasting the efforts on nonvalue adding factors. (K.C. Iyer 2006).

Researchers' definition of word frequency analysis lists delay in land acquisition and environmental clearances, weak capability of contractors, rigid contracting and legal structures, and fund constraints as key reasons for delay in megaprojects, adding to the already-present conflicts and time and cost overrun parameters. (Jay Mevada 2017). There should be more of a focus on using project implementation as a training mechanism for building indigenous skills, according to the literature study conducted by Asare Bediako Adams (2017). There has to be a clear definition of project outcomes that include enhanced planning, administrative, and technical capabilities. International aid evaluations consistently stress the need of hiring qualified professionals in the field of development administration, particularly those with experience in project management. There are two distinct sorts of skilled project administrators needed in developing nations: those who can plan and organise the full project cycle as an integrated process, and those who can administer the project as an organisational entity after it has been chosen and authorised.

Researchers and reviewers terminate that how project planning, scheduling and risk mitigation references contributes only at the planning management level but when it comes to execution of the number of activities and tasks affected by miniature related tasks and activities, it also intends that to take those miniature tasks also as the strategic execution management systems in terms of pre-performance checklists of minority things related equipments and materials, labours, skilled engineer at execution of activity stage, post-performance checklists of tasks, material consumption and wastage, etc. The benefits of planning in projects vary with factors such as the degree of performance risk, the planning technique used, and the performance component being optimised for. Therefore, managers should tailor their methods of implementation to the specifics of each project.(Zwikael 2021).

The Bar charts / Gantt Charts, PERT/CPM network, are some of the tools and techniques used in conventional project management to implement. On the other hand, software like Primavera, Microsoft Project adopts a strategy that views project activity from a high level. It is often depicted as a continuous flow of work units assigned to the project to carry out its duties. the traditional and advanced construction management tools (including web-based packages) in an effort to comprehend the restrictions that emerge from building technology and to examine

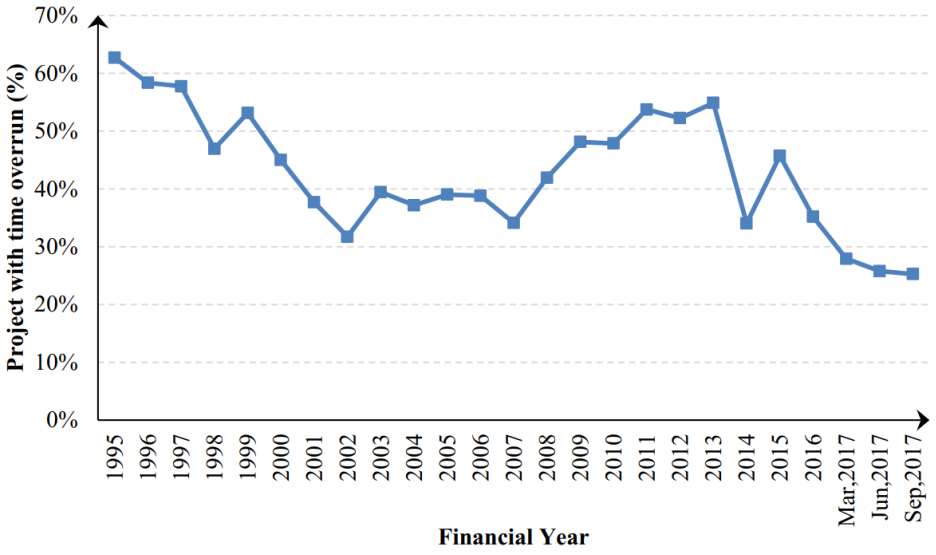
efforts made to get beyond those limitations. The building industry's driving drivers of development were mostly left out of this narrative. Therefore, there is a huge possibility for additional factors analysis when it comes to comprehending the dynamics of the construction technology related constraints they bring about. Further more to banish the myth that software management tools are too complicated and time-consuming to learn, despite the fact that they are simple, time-saving, resourceful, and liable to increase one's proficiency. This folklore is held by construction managers and other people in the building industry (Arpita Srivastava 2023).

From the publications it illustrate that the researchers have identified the stuff at the level of planning and strategic management of the construction projects, also as we delve deeper into the things defined in the publications they whatsoever comes out at the planning and scheduling management systems (Farah Jawdat Khalid 2019), although they are relatively favorable for the particular belongings and positively results out for the large infrastructure projects but as we considers the level of building construction projects those planning and management criteria are excessively technical for those participants(builders), contractors and engineers to tackle. Consequently, in building construction projects the constraints are squarely feasible as the terms are useful like planning and scheduling of activities and tasks, predefined checklists for upcoming activities, post performed checklist for quality parameters, progress related criteria for scheduled related performances of construction activities, etc. There are few additional findings included as cost and time overrun of construction projects from literature analysis.

3. Literature Statistics Amassment

Data Collected From journal of the institution of engineers (India): Series A

The data below in fig 1 was assembled from J. Inst. Eng. India Ser. A Paper published in the journal from 1995 to 2017 for the purpose of assembling data (Time and cost overrun of construction projects) The total percentage of project with time overrun in journals was discovered using these keywords, and the information was displayed as line chart.

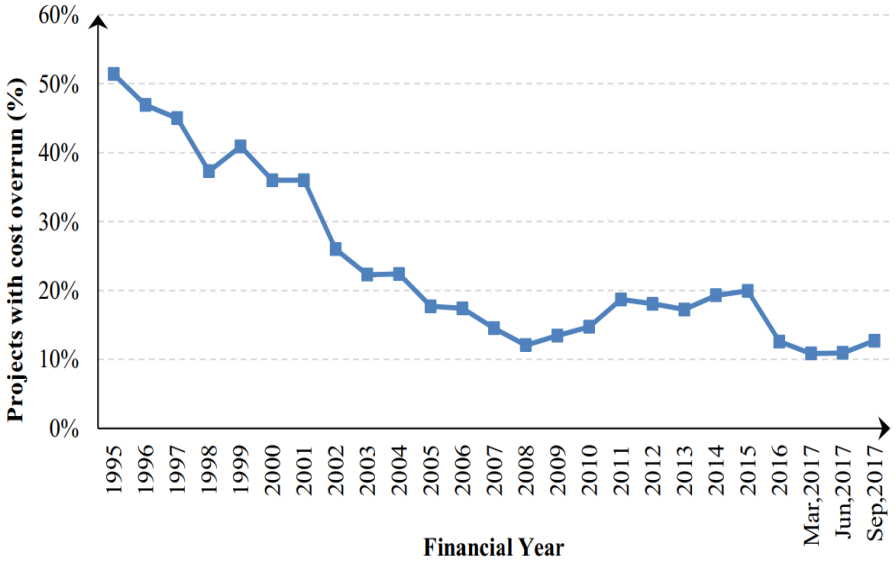


(Fig .1 1995-2017 Statistics shows related to Time Overrun)

(Source: - paper data from J. Inst. Eng. India Ser. A)

Data Collected From journal of the institution of engineers (India): Series A

The data below in fig 2 was assembled from J. Inst. Eng. India Ser. A Paper published in the journal from 1995 to 2017 for the purpose of assembling data (Time and cost overrun of construction projects) The total percentage of project with cost overrun in journals was discovered using these keywords, and the information was displayed as line chart.



(Fig .2 1995-2017 Statistics shows related to Cost Overrun)

(Source: - paper data from J. Inst. Eng. India Ser. A)

4. Methodology

The factors associated with construction execution process were determined by a thorough examination of the literature from numerous journals. This study uses the methods of the aforementioned national and international academics to determine the influence of several factors on delay in the Indian building construction industry using a questionnaire survey. Researchers in India polled construction industry experts to get their perspectives on the state of the industry there. An essential requirement for capturing the effect of different factors on construction delay is the heterogeneity of respondents.

4.1 Questionary Based on Scrutinization of Construction Execution Handling

The constituents affiliated with execution of building construction projects has been adopted from literatures that impact of various attributes to the execution management of projects. The part of those attributes contains the questionaries related to the execution procedures such as tools and techniques using for execution management, regular reporting systems with predefined checklists, detailed systems to compare the actual planned duration to the execution schedule performance, preperformance checklist criteria related the minor items for execute the tasks, mentality about skilled engineer on site, etc.

4.2 Ranking of attributes for data analysis

The following equation may be used to determine the relationship intensity index (RII), which has been employed by several researchers in place of the mean and standard deviation of each characteristic in order to evaluate ranks as a whole:

RII (Relative Importance Index) = $\frac{\sum W}{A*N}$

W = Weight given to each attribute by respondent
A = Highest weight
N = Total number of respondents

Attributes are ranked from highest RII (1) to lowest RII (5), where (1) is the attribute having the most influence on time and cost overrun and (5) is the attribute with the least impact on time and cost overrun. However, the interdependence of these characteristics is not discussed in RII.

5. Data Collection

The questionnaire was disseminated to different businesses, groups, builders, contractors, subcontractors and engineers by hand and with the aid of mail service technology, and this method allowed for the collection of all the necessary and pleasant data. Entire form consists two sections A and B. Section-A contains general knowledge with respect to Such as organizational name, years of experience, type of work, while Section-B contains the questionary regarding the tools and techniques, checklist criteria, execution management system.

Success in the research depends on gathering testimonies of important features of the study and embedding the questionnaire. There has been a lot of research done on the factors that lead to construction projects running over budget and behind schedule, and a comprehensive list of delay features has been published and evaluated by experts in the field. The questionnaire used in this study was designed with the help of the literature on delay times. A total of 26 causes of construction delays were identified. The survey form was disseminated to various designators affianced in the building industry, including builders, business groups, contractors, subcontractors and engineers from the few cities of south-east Gujarat.

A total of 244 surveys were given out during the data collection procedure at the level of selection, and 137 remarks were accumulated from those. From business groups and builders 64 responses accumulated, Responses from contractors and subcontractors were 47, and Engineers provided 26 responses out of the total. Accumulated data was from the cities of south-east Gujarat state namely Surat, Vadodara, Bharuch, Ankleshwar and Valsad. The percentage of responses from each category are defined in table form.

Table 1 Percentages of respondents of categorized responders

Sr. No	Respondent	Questionnaire distributed	Responses received	Percentage of responses
1	Business group & Builder	103	64	62.14 %
2	Contractor & Subcontractor	87	47	54.02 %
3	Engineer	54	26	48.15 %

5.1 Data interpretation

For the data accumulation we used the number system for identification of the attributes responsible for the time and cost overrun of building construction project. The category of the numbers defines as number 1 defines very less, 2 is for less, 3 is for mid-range, 4 is for high and 5 defines very high. As per these categorical criteria from the respondent' s responses on particular attributes by using the RII format interpreted the relative importance index and from that defining the rank for the attributes as which are more considerable for the minimization of time and cost overrun of building construction projects. Here interpretation of data is according to utility of particular attribute at execution level.

Table 2 Ranking of attributes according to utility

No	Attributes	RII	Rank
A	Planning and scheduling tools and techniques	0.633	8
B	Execution management tools and techniques	0.369	20
C	Bar chart for project progress system	0.932	2
D	CPM & PERT methods for planning and scheduling	0.315	23
E	Construction management software – M s project / Primavera	0.387	19
F	Tradition paper work reporting system	0.837	4
G	Related activity checklist criteria	0.323	22
H	Preperformance checklist criteria for tasks	0.298	24
I	Post performance quality checklist criteria	0.602	9
J	Daily material consumption report	0.724	5
K	Crosscheck and approval system	0.564	11
L	Provision of estimated material for activity execution	0.493	16
M	Estimated and calculated contract document agreements	0.520	14
N	Project delayed durations more than 6 months	0.961	1
O	Material availability checklists before particular activity	0.698	6
P	Proper machinery and equipments checklist criteria	0.543	13
Q	Labour safety checklists	0.412	18
R	Risk mitigation during planning and scheduling	0.286	25
S	Training of engineers and labours related to technical aspects	0.343	21
T	Due to delay in project completion cost overrun of projects	0.853	3
U	Execution data management system	0.582	10

V	Record management system for delayed and over consumption of materials	0.466	17
W	Checklist documents each and every activity and task	0.233	26
X	Delay in payments caused the project execution duration	0.550	12
Y	Effects of relations with contactors and other parties	0.653	7
Z	Material storage specification criteria	0.504	15

Table 3 Ranking of attributes weighted average of responses

No	Attributes	Weighted average index	Weighted average rank
A	Planning and scheduling tools and techniques	3.16	8
B	Execution management tools and techniques	1.84	20
C	Bar chart for project progress system	4.66	2
D	CPM & PERT methods for planning and scheduling	1.57	23
E	Construction management software – M s project / Primavera	1.93	19
F	Tradition paper work reporting system	4.18	4
G	Related activity checklist criteria	1.61	22
H	Preperformance checklist criteria for tasks	1.49	24
I	Post performance quality checklist criteria	3.01	9
J	Daily material consumption report	3.62	5
K	Crosscheck and approval system	2..82	11
L	Provision of estimated material for activity execution	2.46	16
M	Estimated and calculated contract document agreements	2.60	14
N	Project delayed durations more than 6 months	4.80	1
O	Material availability checklists before particular activity	3.49	6
P	Proper machinery and equipments checklist criteria	2.71	13
Q	Labour safety checklists	2.06	18
R	Risk mitigation during planning and scheduling	1.43	25
S	Training of engineers and labours related to technical aspects	1.71	21
T	Due to delay in project completion cost overrun of projects	4.26	3
U	Execution data management system	2.91	10
V	Record management system for delayed and over	2.33	17

	consumption of materials		
W	Checklist documents each and every activity and task	1.16	26
X	Delay in payments caused the project execution duration	2.75	12
Y	Effects of relations with contactors and other parties	3.26	7
Z	Material storage specification criteria	2.52	15

As indicated interpretation of data in the table are based on the accumulated responses, with the higher the use of attribute receiving the higher RII rank and also acquiring the higher rank of Weighted average of responses on particular attribute.

5.2 Derivatives and discussion

As mentioned in interpretation of data related to particular attributes it defines the ranking system as the more use of attribute meeting the higher rank of relative importance, but for defining the actual parameter which indicate that the need of use of those attributes which are getting the lower rank in terms of use of the attribute we went with the reverse approach we have described the ranking of attributes getting lower ranks are the important attributes to be taken care for the overcome the time and cost overrun of building constructions.

From the approach we described the attributes obtaining lower RII value are the important for tackle the execution of construction to be managed more accurately. Accordingly, we provided the highest rank to the attribute obtains lower RII value and the lower rank to the attribute obtains higher RII value. Additionally, we described the top ten attributes from mentioned in paper to be considered for the execution management system which may result in overcome the project delay duration of building construction projects.

Table 4 Ranking of attributes according to importance for consideration

No	Attributes	RII rank	Importance rank
W	Checklist documents each and every activity and task	26	1
R	Risk mitigation during planning and scheduling	25	2
H	Preperformance checklist criteria for tasks	24	3
D	CPM & PERT methods for planning and scheduling	23	4
G	Related activity checklist criteria	22	5
S	Training of engineers and labours related to technical aspects	21	6
B	Execution management tools and techniques	20	7
E	Construction management software – M s project / Primavera	19	8
Q	Labour safety checklists	18	9
V	Record management system for delayed and over consumption of materials	17	10

According to the derivations mentioned it is defined that the importance of the 'Checklist criteria for each and every activity' is influencing the higher rank related to the consideration of the attribute to the execution level of building constructions. As mentioned, in consideration ranks of the attributes it also defines the importance of attributes as risk mitigation during the planning and scheduling, performance checklist criteria for activities, use of planning and scheduling methodologies e.g., CPM & PERT, related activity checklist criteria are the other top four attributes to be considered for the execution management system in building industry.

Although, other mentioned attributes considerations are also similarly important at the execution management level for the tackling out the time and cost overrun of the building construction projects. From data collected and interpreted it is also definable that from mentioned attributes the consideration of some of the attributes are barely. Which defines the traditionality in the construction execution management systems, mentality of the project participants regarding the advanced tools and techniques, training and communication gap in between executive team and many more belongings affects the building construction industry in terms of best planning and execution management systems.

6. Conclusion And Recommendation

In order to identify the factors relating to construction execution and indicate the actions needed to enhance execution management, in this investigation, we conducted a comprehensive literature search and data survey from the cities of south-east Gujarat state. The study defines that the factors related to execution management affects the attributes related to planning and scheduling according to estimation and calculation criteria relevant to the project time and cost overrun. Improvements in education and training are essential if construction projects are to increase their familiarity with and effectiveness of risk management strategies. (Kennedy Christopher Obondi 2021).

The building construction industry has several problems, but one of the largest is its insolvent construction execution management system. In spite of its importance to building construction firms' bottom lines, execution checklist criteria are also the most unpredictable of a project's each and every particular activity. The construction sector might benefit greatly from better time and cost overrun management if its participants(builders), Contractors and engineers were more productive with their specific execution management systems. The success of this mechanism depends on identifying and fixing the problems that slow down the completion of these initiatives. As per Arpita Srivastava (2023) the myth that software management tools are too complicated and time-consuming to learn, despite the fact that they are simple, time-saving, resourceful, and tend to increase one's proficiency. This myth is held by construction managers and other people in the building industry.

According to data interpretation and derivatives it is suggestable that the consideration of the criteria which is impacting the execution management systems in building industry in terms of time delay, cost overrun, quality parameters, material safety parameters, skilled execution team criteria, tools and techniques for simplify the execution system of construction, pre and post performing checklist documents for each and every activity and minor tasks related to activity, etc. should be taken into consideration for the better growth and perfection in project execution system.

The current study highlighted the most critical attributes related to execution management as follows: ineffective supervisors/execution management and planning; a lack of checklist criteria regarding materials/tools/equipment; job effectiveness/experience; a lack of dedication/motivation; and worker efficiency/skills. The analysis may help building construction

managers make better use of tools and techniques related to execution of projects for the factors impacting executive productivity. The sample size of the analysis for research is meager as of that similar or the further deep analysis should be evolutionary for mega cities of India.

Acknowledgment

I would like to acknowledge to Dr. Devanshu Patel, President of Parul university, Dr. Vipul Vekariya, Dean of Faculty of Engineering and Technology, Dr. Swapnil Parikh, Principal, Parul Institute of Technology, Dr. Jaymin Kantilal Bhalani, Vice Principal of PIT, Asst. Prof. Shilpa Pathak Head of Civil Engineering Department, PIT, Assi. Prof. Dhiraj Bachwani, Assi. Prof. Mamata B Rajgor, Civil Engineering Department, Parul Institute of Technology, Vadodara for their continuous motivations, guidance and infrastructural support to carry out this research study.

References

1. Hemanta Doloi, Anil Sawhney, K.C. Iyer, Sameer Rentala (2011). Analyzing factors affecting delays in Indian construction projects. International journal of project Management (30):479-489.
2. Syed Nihas, Kristen C Barlish, Dean T Kashiwagi (2013). Construction industry structure in india.
3. Sowmya Narayanan, Amol Madhav Kure, Sivakumar Palaniappan (2018). Study on time and cost overrun in mega infrastructure projects in india. Journal of the institute of engineers (India): Series A.
4. Michal Gluszak, Agnieszka Lesniak (2015). Construction delays in client' s opinion – multivariate statistical analysis.
5. Fatemeh Nouban, Moath al-husban, Mohamad Khaled Abed el Rahim, Albaraaharahsheh (2020). Risk analysis and management in construction industry (Time, Cost and Quality). Academic research international Vol. 11(1).
6. K.C. Iyer, K.N. Jha (2005). Factors affecting cost performance: evidence from Indian construction projects. International Journal of Project Management (23): 283–295.
7. K.C. Iyer, K.N. Jha (2006). Factors affecting cost performance: evidence from Indian construction projects. Journal of construction engineering and management (132): 871-881.
8. Jay Mevada, Ganesh Devkar (2017). Analysis of reasons for cost and time overrun in indian megaprojects. MATEC Web of Conferences 120, 02018.

9. Asare Bediako Adams (2017). Project management for developing countries: Back to basics. Dama international journal of researchers. Pages: 05-09
10. Zwikael (2021). Planning to fail: When is project planning counter-Productive? IEEE Transactions on Engineering Management
11. Arpita Srivastava, Er. Mano Kumar Rajak, Dr. Flulena Rajak, Dr. B.K. Das, Dr. Ravish Kumar (2023). Advancement in construction management: An analytical overview. 2nd International conference on civil infrastructure and construction. Paper ID:284
12. Kennedy Christopher Obondi (2021). The utilization of project risk monitoring and control practices and their relationship with project success in construction projects. Journal of project management
13. Farah Jawdat Ibrahim Khalid (2019). The Impact of Poor Planning and Management on the Duration of Construction Projects: A Review. ResearchGate publication
14. Vahid Shahhosseini, Mohammad Reza Afshar, Omid Amiri (2017). The Root Causes of Construction Project Failure. ResearchGate publication
15. Mayank Kumar Singh, Shumank Deep, Rajeev Banerjee (2017). Risk management in construction projects as per indian scenario. International Journal of Civil Engineering and Technology. Vol. 8 pp. 127-136.
16. Ibrahim Mahamid, Amund Bruland, Nabil Dmaidi (2012). Causes of Delay in Road Construction Projects. Journal of Management in Engineering (28): 300-310.