

# Project Success through Planned Project Closeout

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## ABSTRACT:

One of the most important things for all the stakeholders engaged in practically any construction project is to finish it on schedule. For the entire project team, a late project completion brings plenty of issues. This report aims to establish some of the factors that contribute to project delays during the closeout phase and also to mitigate them. Analysis on standard operating procedures of the organization regarding closeout has been intensively done to identify the missing gap between what is prescribed and what is actually happening. Root cause analysis has later, been conducted to establish the root of the delay in terms of causes and mitigation measures has been suggested. Early project closeout planning, incentives for early completion, penalties for late completion, quick settlement of change orders, reduction of punch list items, and timely payments were all viewed as successful strategies for avoiding project closeout delays. Finally, in order to improve project closeout, the data revealed that financial incentives for on-time completion and penalties for delays might be an effective technique for resolving the problem.

**Keywords:** Project closeout, project lifecycle, handover phase, residential projects.

## I. INTRODUCTION

### 1.1. Identification of research gap

Although there are studies in which various elements impacting the ultimate closeout of a project have been enumerated and examined, they are mostly done by foreign researchers and are

quite case specific. Existing buildings hold a substantial amount of untapped energy, which is referred to as the "lock-in" phase during the life of the structure. (Basu et al., 2017) The selection criterion might be a multi-objective optimization problem with a variety of restrictions and limits, such as particular building features, total budget available, project aim, kinds and efficiency of building services, building fabric, and so on. (Basu et al., 2019) There is room to examine all of the essential aspects that impact the completion of a public building project in India. There are unexplored parameters responsible for the seeming disparity between the desired output and what the contractor actually delivers. This area of research, in the scholarly community, it is already gaining traction. (Havila et al., 2013) and numerous organizations are getting benefitted from having an improved closing stage processes.

### 1.2. Need for research

In recent times, there have been discussion on project success evaluation and the possible factors leading to success of a project. Traditionally, handing over the project outputs during closeout phase is considered as a point of measuring the success of a project but today, evaluation of project success happen beyond the close out phase. This is ensuring the better account for organizational and societal outcomes. (Fahri et al., 2015) The workload management task must be done accurately and speedily to get rid of routine and time-consuming project tasks. (Gupta et al., n.d.)



Figure 1.1: Typical Earned-Value curve in closeout delay cases

As the project's finish date approaches, the project manager will confront a whole new set of problems in order to complete it successfully. Even if everything goes according to plan, this assertion holds true (Rogers, 2012). The project might be finished on time, within budget, and to the desired quality level, yet it fails (Sanvido, 1988). From each stakeholder's perspective, there are various causes that might cause a project's delay or inefficient closeout. Although the amount of work remaining to do after Substantial Completion is often a modest percentage of the entire contract work (less than 1% of the contract value), finishing the punch/ snag list takes an unreasonably long time. In extreme instances, the time it takes to complete the last 1% of a project might take as long as the first 99%, resulting in an earned-value curve similar to the ones illustrated in figure. The transition from physical completion to final completion should be straightforward. The building services and equipment are also tested, commissioned, and verified after physical completion. This method might potentially cause delays owing to disappointing outcomes. As a result, many projects do not reach Final Completion by the deadline, resulting in severe effects for all stakeholders. (Carson et al., 2009)

“Frequently project closeout activities are underestimated and not sufficient time is invested in framing the process of actual closing out of a project. This many a times lead to either dragging project closure unnecessarily or premature closer.” (Havila et al., 2013)

### 1.3. Aim

To develop an adaptive framework to plan project closeout effectively for a public project success.

### 1.4. Objectives

- i. To assess all the aspects & activities of project closeout planning and identify the factors affecting closeout of a project.
- ii. To assess and validate the identified factors affecting project closeout through case studies and surveys.
- iii. To analyze the recognized factors on ground through case studies and identify the gaps in implementation of closeout plans effectively.
- iv. To propose a framework and recommendations to improve planning of closeout phase of a construction project effectively.

## II. LITERATURE REVIEW

### 1.5. Introduction

Exploration and establishment of the general conceptual discussion on project, project management, project lifecycle and its stages, project close out and all the activities which needs to be carried out during this phase and lastly, the cause and factors responsible for the delay in closeout of a project.

Project: “A temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a beginning and an end to the project work or a phase of the project work. Projects can stand alone or be part of a program or portfolio.”(PMI, 2021)

Project Management: “The application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management refers to guiding the project work to deliver the intended outcomes. Project teams can achieve the outcomes using a broad range of

approaches (e.g., predictive, hybrid, and adaptive).”(PMI, 2021)

The value and utility of a building/project can be maximized by standardization of procedures, optimum designs, and appropriate materials; nevertheless, the idiosyncrasies and limits on site may drive designers and project managers to adapt and adjust as needed.(Sreekumar et al., n.d.)All projects are managed using these project management skills, tools, and procedures, which are performed through the use of the initiation, planning, execution, monitoring & controlling, and closing stages. Because projects are often shorter in duration and more volatile than businesses, they will focus on forming a collection

of deliverables within agreed-upon cost, time, and quality limitations. To achieve this, a project is designed as a temporary flexible organization structure created to coordinate, direct, and oversee the implementation of a set of related projects and activities in order to deliver output and returns related to the organization's strategic points; to achieve this, a project is designed as a temporary flexible organization structure created to coordinate, direct, and monitor the implementation of a set of related projects and activities in order to deliver output and returns related to the organization's strategic points.(Shay, 2019)

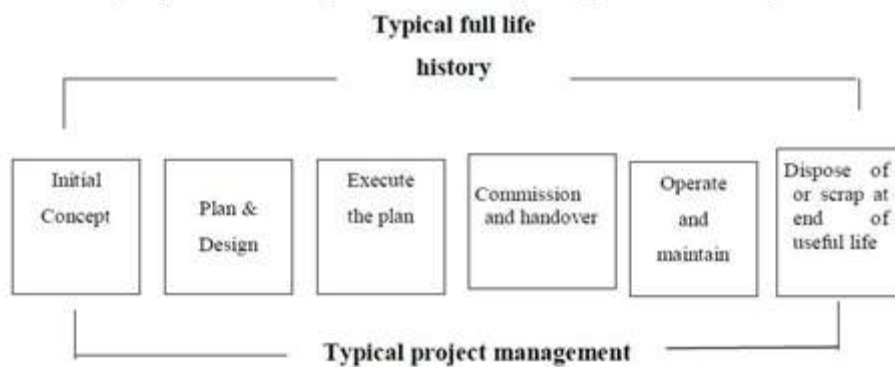


Figure 2.1: Typical project lifecycle

#### 1.6. Project Lifestyle Stages

A project's lifetime is analogous to that of a biological being: it is born, lives, and dies. There is no one-size-fits-all lifecycle model that can be used for all projects. Because projects differ from one another in real life, the project lifecycle may differ for each project(Lock, 2007). Nonetheless, these models are valuable for determining and guiding from project inception through project completion.

The traditional project development stages are initiation, planning and design, executing, monitoring and controlling, and closing. A typical full project life cycle consists of the following phases – conceptualization, planning and design,

implementation, handing over, operation and maintenance, and termination (dispose) of the project(Lock, 2007). (PMI, 2017)

When discussing the project lifecycle, it's useful to take a quick look at how staffing and resource requirements change over time. As shown in Figure, project costs and workforce levels are modest at the outset, progressively climb as the project progresses through implementation, and then decline as the project nears completion. (Stoshikj et al., 2013)

This discussion will lead to understanding of project closeout phase in a more and detailed manner.



Figure 2.2: Typical cost and staffing level across project lifecycle

### 1.7. Project Closeout

In the construction business, project closeouts are a difficult component of project management. In spite of this, it is relegated to the background because to its unexpected, fluctuating, and dynamic character, which can have serious effects if not properly managed. Even big businesses, especially those that operate in various project settings, typically underestimate the importance of the last phase of the project lifecycle. Professionals in the construction sector have a propensity to shift their emphasis from one job to another, wasting time and money in the process. Projects continue to fail as a result of this strategy, and corporations dodge course parallels because they lack the time to do so. (Kaul, 2014)

Tyler A and Johnson (2017) states that the time between the completion of building and the signing of a contract is known as project closeout. During closeout, money are held in overburdened project reserves as well as contractor's bonding capacity. (Johnson et al., 2017)

The period and activities that occur between the conclusion of construction and the signing of a contract are referred to as project closeout (i.e., final contract payment, submission of as-built project plans, and verification of quantities). At project closeout, project resources are limited in terms of encumbered money. Contractors' ability to get financial bonds is likewise limited by their financial resources. (Shay, 2019)

### 1.8. Commissioning Phase

The project's Commissioning Phase is not just the last stage of the project's life cycle, but it's also an anti-climactic one in many aspects. The thrill of the Execution, with its flurry of activity and essential dependencies, gives way to a greater emphasis on efficiency: checklists, tests, debugging and rigorous documentation become the norm. Any project goal is to provide the required facilities in stipulated time & budget to end users. The quality is also measured on how the project is perceived by the end user. (Kasana et al., n.d.)

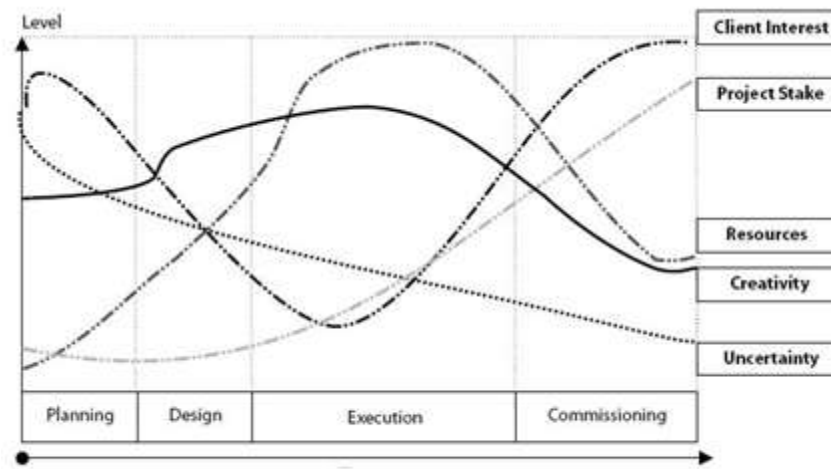


Figure 2.3: Client Interest, Project Stake, Resources, Creativity & Uncertainty relationship during project lifecycle

The Commissioning Phase begins with the delivery of the first significant deliverable and ends with the formal delivery of the facility, product, or service to the client— whether inside or external to the sponsoring company. In any case, the Commissioning Phase has the greatest stakes, with enormous risk and severe implications owing to the project's overall expenditure. Figure 2.4 shows how, as the project life cycle progresses, the uncertainty about the project outcome reduces as the project's investments—and hence the stake—increases, reaching its peak levels during the Commissioning Phase. Furthermore, after peaking during the design and implementation phases, the amount of originality required for activities rapidly declines. Similarly, as the project nears completion, we witness a significant reduction in resource deployment. (Victor Sohmen, 2002)

In this context, we must consider the project's goal: to provide the client with a product, facility, or service that meets performance standards and is delivered on time, on budget, and on schedule. In the last two decades, firms' increased attention on consumer happiness has fueled competitiveness, improved quality, and fueled innovation. Despite project practitioners and even project management scholars' lack of interest in the Commissioning Phase, the customer is more interested in the early and final stages of the project: the Planning Phase and the Commissioning Phase, figure 2.3 illustrates this. The customer wants to make sure that the specified needs are explicitly established and scoped out at the beginning of the project. The customer asks near the end of the project, "Will the project be completed on schedule and to our specifications?" Naturally, at the end of the project, the client's

interest is at an all-time high. As a result, both the project and its customer have a lodged interest in project's success. (Victor Sohmen, 2002)

#### 1.9. Ways to closeout projects

Project Management Institute and several organizations suggest, there are fundamentally, five types of project closure or termination which can happen with a project:

**Closeout by extinction:** If a project must come to an end, either because it was successful or because it was failed, without being extended in any way, then this comes under termination/ closeout by extinction (Victor Sohmen, 2002). The project which has fulfilled its ultimate goals for which it was started, can be considered as a successful project; nevertheless, there are additional criteria that are used to determine project success. (George, 2018)

**Closeout by addition:** When a project becomes a separate entity and its properties are often integrated with the existing or newly created organization, then this closeout is considered to be termination/ closeout by addition. This is usually done with an exceptionally successful project which then, has to get institutionalized with the parent firm. (George, 2018).

**Closeout by integration:** This is the most common and sophisticated approach to dealing with profitable ventures. The project's output is incorporated into the operational systems of the parent or customer, and it gets embedded in day-to-day operations. This needs complete integration with primary operations at several levels, with output disseminated across current processes. (Victor Sohmen, 2002).



**Closeout by starvation:** The human, the capital and material resources necessary to finish the project are decreased, as the term suggests. When a project fails, top management in certain firms finds it difficult to accept. As a result, they may wish to drastically cut the project's budget in order to cripple project operations and impede future advancement. Despite the fact that the project exists in theory, it has been cancelled and permitted to continue for legal reasons. For legal considerations, the project is virtually defunct and is only receiving minor life support. This predicament usually arises when top management is hesitant of declaring the project a failure due to political or other considerations.(George, 2018)

**Closeout by suspension:** Generally this situation occur when project is being put on hold and to be resumed after sometime (undefined). For example, canceling a project to ensure the availability of the required components for the project's continuation. Only way for a project to progress is when required components are made available, and of they are not management may decide to terminate it. (George, 2018).

In summary, regardless of how the project is terminated, it should be done with care to avoid severe harm and damages to the parent company or customer, the project & the workers. It is essential to have ability and skills to terminate or closeout a project so that it incur minimal or no harm between project stakeholders and company relations. (Havila et al., 2013)

#### 1.10. Construction project closeout activities

Scenario planning is an organizational social-reasoning method in which participants express their perspectives on logical conclusions to prospective tales generated by a project as it progresses through its stages.(Paul &Basu, 2016)Extracted from different sources, in general, during the project closeout phase, the following activities will be carried out:(Kaul, 2014)

1. Obtain Substantial Completion
2. Complete building commissioning duties such as training, documentation, and testing.
3. Deliver documentation to the owner (record drawings, guarantees, warranties)
4. Conduct joint inspections with subcontractors once their scope of work is finished, and collaborate with them to compile a punch list. Perform a preliminary snag list inspection walk-through with the owner, architect, and design team representatives.
5. Finalize and prepare records for retention or destruction

6. Notify utilities of interim service termination dates.
7. Arrange a municipal building inspection.
8. Complete the final inspection, i.e., reconcile the punch list
9. Complete the final construction site cleanup.
10. Obtaining a Certificate of Occupancy
11. Deactivate the National Pollutant Discharge Elimination System permit until the owner acquires their own.
12. Hold a post-construction meeting with the owner.
13. Provide final payments to subcontractors and vendors
14. Remove subcontractor equipment and supplies from the job site.
15. Carry out a final inventory of the items still on the contractor's property and reconcile them with the records.
16. Remove all construction equipment, materials, general-purpose equipment, furniture, and supplies from the location.
17. Complete a final clean and sweep of the building and premises.
18. Verify that all transitory utilities have been turned off.
19. Obtain final lien releases from subcontractors.
20. Sign Construction Completion Certificate
21. Provide waiver and release to owner
22. Obtain final payment and release of retainage from owner
23. Prepare final project report, including financial data
24. Complete and turn in final record drawings
25. Provide future contractor contact information to all parties.
26. Obtain a surety release.
27. Obtain final payment from the owner with the release of retainage
28. Provide the owner with an affidavit of final project payment
29. Prepare the project's final report (analyze planned vs. actual schedule, financial and budget, safety, quality & other project objectives for lessons learned)

The following items should be addressed as part of the project review process at the end of the project.(Rogers, 2012):

1. Project performance — a comparison of results to the original plan
2. Administrative performance – examine the organization's administrative operations.
3. Recommendations for modifications to the organization's structure

4. Team performance - provide a confidential report to top management on the efficacy of the team members.
5. Project management techniques - examine the strategies for estimating, planning, and cost control.

#### 1.11. Causes of project closeout delays

Delay is defined as a time excess beyond the parties' agreed-upon project completion deadline. Delay may also be described as an act or occurrence that increases the time necessary to complete the contract's work and presents itself as extra days of labour. (Durdyev & Hosseini, 2019) Delays in construction projects are one of the most typical issues, resulting in a slew of negative consequences for the project as well as its participants. The primary issue with closeouts is that project managers seldom get started abundantly. (Kaul, 2014)

Improper planning, poor site management, insufficient contractor experience, insufficient client finance and payments for completed work, problems with subcontractors, material shortages, labour supply, availability and inability of equipment, failure to communicate between parties, and mistakes during the construction stage are the most significant causes of project delays in the construction industry. (Sambasivan & Soon, 2007)

Aside from the requirements/expectations that a user has from the building that he or she inhabits, there are a few other elements that impact user happiness, such as the facilities that come with the building and the sociocultural pattern in the neighborhood of the residential complex. (Seshadhri & Paul, 2018) Due to numerous revisions, scope changes, and decision delays, a lack of expertise among consultants for providing acceptable design may cause project delays. (Paul et al., 2021) This section seeks to identify the primary reasons of project closeout delays from the perspectives of the three key stakeholders: contractors, consultants, and clients. The major goals are to identify the areas that stymie the process and/or are overlooked throughout the closeout process, as well as the repercussions. The following are the reasons for the delay:

#### 1.12. Sub-contractor related closeout delay causes

When the project enters the construction stage, the main contractor and subcontractors begin their primary responsibilities. Contractor expertise, site management, subcontractor supervision and engagement, contractor cash flow, cost control

system efficacy, and information flow speed are among the variables. (Chan et al., 2004)

Subcontractors are frequently threatened with financial troubles if payments are delayed, which might lead to the subcontractor's failure. Poor subcontractor performance is one of the major contributors to construction delays in both regions. When a subcontractor is unable to perform the task, it might cause complications for the primary contractor. If the subcontractor underperforms due to inexperience, the project may be delayed. As a result, when choosing a subcontractor, it's important to analyze their track record, particularly in terms of performance. (Shay, 2019)

An unskilled contractor working on a project may not realize the revenue loss for a day and may cause the work to be delayed to the point where the project lack of revenue is significant. If necessary, skilled contractors will implement appropriate acceleration measures in their programmes. Therefore, this can be established that Bad site supervision on site, poor site management/supervision, inappropriate construction technique, insufficient experience, construction blunders, poor subcontractor performance, faulty of works, and incorrect planning are all causes of contractor delays. In other circumstances, the contractor experienced delays as a result of overly optimistic estimates and erroneous work evaluation, which caused delays and hampered the project. An unskilled contractor or subcontractor is a constant challenge to management sources when there is a lack of task clarification (methods, techniques, process, and coordination). (Saeed, 2009)

Contractors should devote more time and effort to proper planning and scheduling. Planning and scheduling may be altered during construction if essential conditions arise. Only a well-planned and scheduled project may be successfully completed. (Shay, 2019)

#### 1.13. Consultant related closeout delay causes

Consultants have a critical role in design-related delays since they are in charge of the design process in collaboration with the project owner. One of the consultants' primary responsibilities is to monitor workmanship quality during the building period. For example: While solidifying an ancient building, structural designers must first comprehend its structural functioning as well as analyze its performance against various loading condition combinations as per the newest code requirements. (Yadav et al., n.d.)

Changes in drawings, inadequate and defective specifications, and other design

difficulties all have a negative impact on project completion timeframes and ultimately lead to cost increases. These are problems that may be avoided by properly managing the design process and making timely decisions. It is common knowledge that decisions taken early in a project's life have the greatest impact on the project's goals of delivering a safe, high-quality product within the schedule and price constraints (Saeed, 2009) show that the delay may be non-excusable (contractor caused), in which case the client and consultant will need project management tools to successfully manage the delays, or compensable (client induced) delays. The delays might be caused by either party and can occur at the same time.

By completing a questionnaire poll of contractors, consultants, and clients, the leading reasons of construction project delays were identified. They come to the conclusion that the client's lack of funds to finish the job and the owner's delay in progress payments are the two most significant reasons of project delays. (Al- Kharashi & Skitmore, 2009)

#### 1.14. Contractor related closeout delay causes

Financing by the contractor during construction, slow material deliveries, preparation of shop drawings and material samples, lack of database in estimating activity duration and resources, shortage of construction materials, poor labour productivity and errors committed due to lack of experience and coordination, shortage and mismanagement of equipment, death of labour, unskilled operators and poor equipment. (Shay, 2019)

#### 1.15. Owner related closeout delay causes

The client's and client's representative's influence on construction time performance is a crucial factor. Client characteristics, client type and experience, knowledge of building company organization, project financing, benefits resulting in the construction team, owner's construction sophistication, well-defined scope, owner's risk aversion, and client project management are among the client-related factors (Chan et al., 2004). Delays in the owner's payment to the contractor, partial payments during construction, the owner's decision-making process being delayed, acquiring licenses from the municipality, and the project owner's operation being overly bureaucratic.

#### 1.16. Design team related delay causes

During construction, design changes made by the owner or his agent, changes in material types and specifications, waiting for approval of shop

drawings and material samples, design errors/incompletes made by designers, inspection and testing procedures used in the project, unexpected foundation conditions encountered in the field

#### 1.17. Miscellaneous closeout delay causes

Despite being a qualitative feature, quantifying customer happiness is an unavoidable requirement. (S. & Kumar, 2019) The weather effect, the lack of professional construction/contractual management, the difficulty of coordination between the contractor, subcontractor, owner, and consultant working on the project, the relationship between different subcontractors' schedules, the contractor or consultant's poor organization, the contractor and consultant's point of view conflict, the application of quality control based on foreign specifications. Factors like age of buildings, paucity of funds and non-availability of manpower will always affect the User Satisfaction Index. However, these impediments will always remain, especially in government sector. (Seshadhri & Kumar Paul, 2018)

#### 1.18. Solutions for successful closeout

The team should know that it is in their best interest to complete their duties and finish the closeout process as timely and efficiently as possible. Essentially, a project manager must be able to balance the closing of three basic areas: physical job completion, administrative detail and financial agreements (Kaul, 2014). Often, closeout processes turn out to be quite trying and controversial due to the mismanagement of the above factors. (Kifle & Abagissa, 2017)

- i. Leadership, team effort and active communication are extremely crucial during this stage.
- ii. Good communication and a healthy relationship ensures the true nature of successes, failures, obstacles and issues of a project closeout.
- iii. Constant motivation is vital to renewing team enthusiasm and extracting their best performance without bogging down the team with negative vibes.
- iv. It is very important at the same time to follow a separate planned schedule for closeout, which ensures timely inspections, to maintain the standard quality of work.
- v. The owner should not be issuing multiple punch lists and there should be one checklist available with all parties to ensure that a



- fixed set of tasks are monitored and completed well within time bounds.
- vi. Adequate care should be taken to ensure that team members are trained for their new jobs so that they do not face techno- stress.

There is a lot of psychological strain on the employee at the end of a project. Downsizing at the conclusion of a project increases the pressure on the team members remaining to finish the project by requiring them to learn new software for the needed procedure of submitting closeout paperwork, as well as job security pressure when the present job is over. Adequate care should be made to ensure that team members are properly trained for their new duties so that they do not experience technological stress, and that they have been allocated to the next job so that they may work on the closeout phase stress-free and efficiently. (Shay, 2019)

1.19. Factors affecting closeout

An attempt is made through research to obtain an agreement on the types of psychological, technical, financial, and administrative variables that influence project closeout and the extent to which they can slow or speed up the process. Based on the literature review, hypotheses for this study were developed, and now questions will be directed at construction managers in order to gain valuable and found to be highly into this neglected and complex process, as well as to determine whether the enrolled cause would have a substantial enough impact on closeout. (Shay, 2019)The list below is a summary of all elements discovered via an exhaustive literature research that might have a major impact on project completion: (Sanvido, 1988)

Factors	Types
<b>Financial</b>	<ol style="list-style-type: none"> <li>1. Owner directed change orders</li> <li>2. Delay by owner for payment of work before substantial completion</li> <li>3. Contractor project team bonuses or other incentives for timely final completion</li> </ol>
<b>Psychological</b>	<ol style="list-style-type: none"> <li>1. Demobilization of Project managers before final completion</li> <li>2. Stress of learning new technology due to manpower shortage (Example: Software related to the client's database, in order to submit the required documentation to the client).</li> <li>3. Lack of urgency in approach, enthusiasm and motivation of parties involved due to achieving substantial completion</li> <li>4. Demotivation of team members losing their coworkers due to project downsizing</li> <li>5. Barrier in communication flow</li> </ol>
<b>Technical</b>	<ol style="list-style-type: none"> <li>1. Technical Expertise</li> <li>2. Services and other commissioning requirements (green rating certification, etc.)</li> <li>3. Lack in planning and resource allocation</li> <li>4. Unclear SOPs for closeout, in specifications and contractual requirements</li> <li>5. Equipment failure/ accidents during closeout phase.</li> <li>6. Procedural inexperience</li> </ol>
<b>Administrative</b>	<ol style="list-style-type: none"> <li>1. Irregular &amp; untimely documentation of contractual closeout.</li> <li>2. Subcontract closeout requirements.</li> <li>3. Multiple snag lists (punch lists)</li> <li>4. Shortage / Late-arrival of resources, i.e., manpower, materials and equipment.</li> <li>5. State and Municipal regulatory requirement.</li> </ol>

1.20. Inferences

Through this intensive literature survey, the author has identified the factors responsible for

delays during closeout phase of a project, related to the owner/ clients, related to contractors, related to consultants, related to project management and

related to other stakeholders. To get the comprehensive and wholesome idea to pre-plan a project closeout phase considering all the each and every factor affecting each and every activity during the phase. All the identified 19 factors were categorized into four different categories with respect to its typology instead of categorizing them as per stakeholders. These factors are then, taken to a few stakeholders as a part of pilot survey to get the on-site scenario regarding this and if the author requires to add or remove few factors for the final survey.

### III. PILOT SURVEYS, DATA COLLECTION AND DATA ANALYSIS

#### 1.21. Introduction

From the literature survey, factors were identified causing delays in a construction project at the closeout phase. Factors which causes ineffective closeout or delay formed the basis of questionnaire survey. Most important type of factors identified were contractor-related, owner-related, project management related and consultant related.

Methodology for Data collection and Analysis:

1. Factors Identification: Comprehensive list of factors were identified from literature which were used for pilot survey.
2. Pilot Survey: Factors identified in literature review are taken to industry experts mainly contractors, architects, developer and project managers.
3. Case studies: Besides the main survey, three number of cases were analyzed which got delayed during closeout phase, validating identified factors and also identifying few new ones.
4. Design of Questionnaire: Final questionnaire is drafted using factor identified from both literature review and pilot survey.
5. Data Collection: Questionnaire prepared is taken to industry professionals where their responses are recorded for further analysis.
6. Data Compilation: Data will be compiled and structured in a manner to carry out analysis using software.
7. Data Analysis: Collected data will analyzed and findings/ results will be summarized and presented to include critical factors, which wholesomely covers all the major stakeholders to include them in planning of a project closeout.

8. Case Studies and Validation: SOPs of different organizations are critically analyzed with reference to a case example. And findings from analysis will be validated accordingly.

#### 1.22. Pilot Survey

Factors found out in literature survey were taken to industry experts for pilot survey. In pilot survey the classification which was done earlier in five categories namely, contractor related, owner/client related, consultant related, consultant related and project management related is reduced to four categories, eliminating consultant related factors.

This is because as per experience of professionals, at the stage of closeout of a project role of consultant is too less and generally the consultants are driven by client or developer. Hence, this can be included in the factors which got affected due to client or developer.

#### 1.23. Inferences from pilot cases and surveys

Pilot surveys and cases helped getting clearer idea of on ground scenario during closeout and a few factors were added and removed which seemed relevant and irrelevant respectively as per experts' suggestions and case inferences. The factors related to consultants/ sub-contractors were omitted for the final questionnaire survey. Few factors which are added as per ground reality are listed below:

- i. Lack of past project experience
- ii. Role of quantity surveyor and team
- iii. Lack of leadership in final stage
- iv. Poor stakeholder management

#### 1.24. Data Collection

Questionnaire survey was created and floated using Google forms. A total of 80 survey forms were sent to industry professionals through LinkedIn, Whatsapp & email. Since, minimum of 30 responses are required to analyze our data, when  $\sigma$  is unknown and by due date, a total of 53 surveys were received back with responses, subsequent in a nearly 66.25% reply rate.

There are in total 53 responses (shown in fig 3.1) which comprises of 18 Architect/ Designer, 16 Project Manager/ PMC professional, 7 Contractors, 5 Developers/ Owners and 7 consultants. There is diversity in experiences of respondents which ranges from 2 years to more than 15 years. Amongst all the respondents, around 80% of them have been a part of residential projects, 50% in commercial projects, 30% in institutional projects and less than 10% in industrial and other projects (illustrated in fig 3.2).

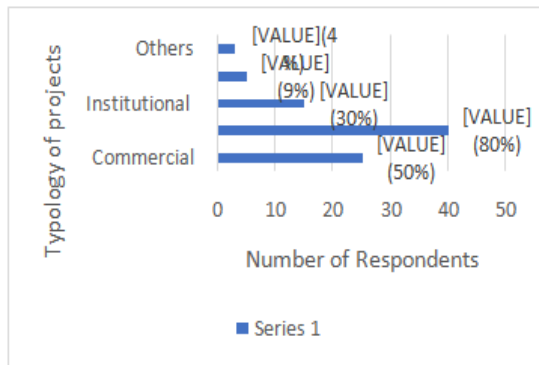


Figure 3.2: Respondents' expertise

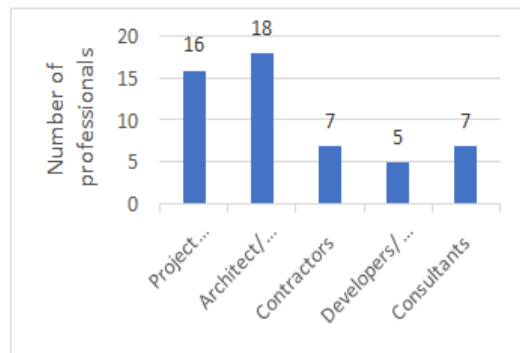


Figure 3.1: Respondents' experience in project typologies

### 1.25. Data Analysis

Relative Importance index is calculated for each factor and average RII of each factor group after testing the reliability of data collected through Cronbach's alpha ( $\alpha = 0.8987$ ). From the analysis, it can be inferred that among four different groups of factors that affect the effectiveness of the closeout the most is Administrative factors

followed by technical, financial and psychological factors. Carried out statistical method is illustrated in Appendix A. The calculated RII results illustrated through tables and graphs below for all 23 factors. Also, ranking has been done for factors within each group to understand the impact of them including comprehensive ranking for all the 23 factors.

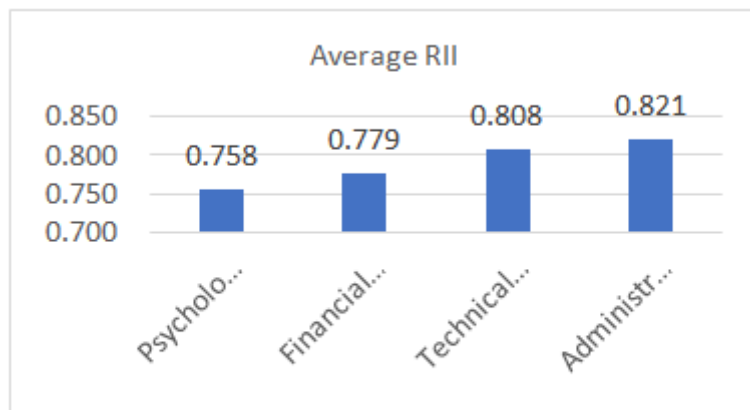


Figure 3.3 Average RII of Factor Groups (Author)

### 1.26. Overall Ranking of Factors

The objective of this priority index to identify the criticality of factors from any category (as all the stakeholders collectively contributed in the data) and mitigate them by ensuring the

consideration of these factors before even starting the closeout phase i.e., in the end of execution phase or even at the start of the project, when planning the closeout stage of the project.

Factors affecting effective closeout of public projects	RII	Rank	Group
Multiple snag lists (punch lists)	0.8868	1	Administrative
Lack of planning and resource allocation	0.8792	2	Technical
Role of Quantity Surveyor during final work measurement and billing.	0.8491	2	Technical
Technical expertise	0.8453	4	Technical
Poor stakeholder management	0.8453	5	Administrative

Delay in payment of work before substantial completion by client	0.8415	6	Financial
Leadership of the project team	0.8377	7	Psychological
Irregular & untimely documentation of contractual closeout	0.8377	8	Administrative
Unclear SOPs for closeout, in specifications and contractual requirements	0.8340	9	Technical
Direct change orders from owner/ client	0.8151	10	Financial
State and municipal regulatory requirements	0.8113	11	Administrative
Lack of past project experience	0.7962	12	Technical
Late arrival of resources i.e., manpower, materials and equipment	0.7925	13	Administrative
Communication gap	0.7849	14	Psychological
Procedural inexperience	0.7849	15	Technical
Demobilization of Project managers before final completion	0.7660	16	Psychological
Services and other commissioning requirements (green rating certification, etc.)	0.7547	17	Technical
Demotivation of team members losing their coworkers due to project downsizing	0.7509	18	Psychological
Subcontract closeout requirement	0.7509	19	Administrative
Lack of urgency in approach, enthusiasm and motivation of parties involved due to achieving substantial completion	0.7245	20	Psychological
Equipment failure/ accidents during closeout phase	0.7170	20	Technical
Stress of learning new technology due to manpower shortage (Example: Software related to the client's database, in order to submit the required documentation to the client)	0.6830	22	Psychological
Bonuses and other incentives for timely final completion	0.6792	23	Financial

Table III.1 Overall Ranking of Factors(Author)

Table 4.5 shows the RII results of all the factors and it is very clear that administrative and technical factor groups have maximum critical factors to contribute in smooth and effective closeout.

#### 1.27. Inferences

The main objective of this chapter was to analyze the factors and identify the most critical ones and to consider them in planning out of closeout SOPs or plans. There were 23 identified factors obtained from extensive literature reviews, pilot cases and pilot surveys. Normalization of identified factors have been done via categorizing them into four common groups irrespective of stakeholders and further, studies are performed to get the rankings.

First 10 critical factors amongst 23 factors which must be handled before planning the closeout. It is very clear that the current remedial measures are only compromises under contractual implications. Although, to have a dynamic systems and SOPs to plan a closeout, considering critical

factors, the process can be improved and made adaptive. Traditional methods and measure should be there, but additionally new and contextual factors which wholesomely considers all the stakeholders along with adaptive mitigation plan should also be implemented to have a smooth and effective closeout.

## IV. CLOSEOUT SOP ANALYSIS: CASE EXAMPLES

### 1.28. Introduction

After recognizing and prioritizing the factors affecting closeout of a project, on- ground reality has been analyzed through different cases of different organization and critically analyzing their SOPs during closeout phase of a project. For achieving the required objective, casual analysis has been done the help of case examples and the root cause of the particular issue regarding SOP has been identified rather than finding the symptoms for the same. All the top priority factors responsible for an effective closeout have been identified and

validated by the industry professional, are listed below with their specified nomenclature for

establish further root cause as per the case example.

Top Factors	Nomenclature
Multiple snag lists (punch lists)	F01
Lack of planning and resource allocation	F02
Role of Quantity Surveyor during final work measurement and billing.	F03
Technical expertise (Appointment of specialized/ experienced closeout manager)	F04
Poor stakeholder management	F05
Delay in payment of work before substantial completion by client	F06
Leadership of the project team	F07
Irregular & untimely documentation of contractual closeout	F08
Unclear SOPs for closeout, in specifications and contractual requirements	F09
Direct change orders from owner/ client	F10

Standard operating procedure of three different case examples are to be analyzed critically to identify the missing issues and its associated factors which need to ensure before the closeout phase to have a smooth closeout of a project. This

analysis will also ensure the validity of recognized factors and can indicate the most critical and frequently occurring factor which must be mitigated while planning for closeout phase of a project.

1.29. SOP 1: ICC- 2 RESIDENTIAL TOWER, MUMBAI

STAKEHOLDERS	
Client	Bombay Dyeing & Manufacturing Co Ltd.
Contractor	L&T Construction
PMC	Hill International Project Management
Lead Architect	Sandeep Shikre & Associates (SSA)
QS Consultant	Aecom India Pvt. Ltd.
Structural Consultant	JW Consultants LLP (JW)



Figure 4.1: Island City Centre- 2 towers

1.30. Project Brief

This is a project of Bombay Dyeing and manufacturing co. ltd. Which is being constructed

as a luxury residential tower (3B + G + Podium + 53 storeys) in Mumbai. The plot area of the tower is 8 acres and total built up area is 26 lakh sq. ft



including two towers, non-tower areas, landscaping and club house.

The completion of this tower was supposed to be done by Aug 2019 and but there was a significant delay during closeout phase of the building.

<b>Contractual completion</b>	<b>20-Aug-2018</b>
<b>Actual final completion</b>	<b>31-Jun-2019</b>
<b>Delay after substantial completion</b>	<b>10 Months</b>

1.31. Causal Analysis

In L&T construction, there is no defined set of standard operating procedure for closeout phase, rather they dynamically define it for each project and monitor it throughout. For this case

each SOP was critically analyzed and issues were noted which arose during the phase. Inferences drawn from each issue were then relationship has been established with the already recognized causal factors to find the root cause of it, on ground.

SNO	CLOSEOUT SOP FOLLOWED	ISSUES	INFERENCES	CAUSAL FACTORS
1	Testing and commissioning of services and submission of their reports	FAPA system demonstration failed during snagging and inspection due to technical issues (sub-contractor: Godrej) and delayed the handover process.	Since, handover was happening floor wise, micro scheduling of training to FM team from client side was scheduled accordingly, but during demonstration of drilling fire alarm system failed and snag was recorded. There were no previous testing records available regarding the same which happened due to irregular documentation of work. Because of the enormous number of malls and the complexity of their structures, predicting smoke movement in the event of a fire is challenging. As a result,	F02, F08, F09

			evacuation plans are difficult to establish.(Kumari et al., n.d.)	
2	<b>Critical room handover (services control rooms, reception, office area)</b>	Reception area, mock-up flats and services like STP, Firefighting and HVAC were supposed to be handed over to clients' FM team with training and manuals. This got delay due to:	1. Improper planning and tracking of handing over activities by the PMC. 2. Buffers to delays were exhausted during execution phase due to statutory approval issues from fire department. 3. Unforeseen delays like custom approvals were listed in risk register but couldn't properly reflected in planning of closeout.	F02, F04, F07, F05
	Plant technical data	1. changes in mock-up room by the client and failure of FAPA.		
	Operating procedures	2. Delay in arrival of Loose furniture in customs.		
	Maintenance Manuals			
	Record Drawings			
	Warrantee certificates			
	Testing and commissioning reports			
3	<b>Punch list completion and micro scheduling and tracking the progress</b>	There was lack of urgency from client side and handing over become the most difficult job, as: 1. Flat and floor wise handing over was agreed upon as per the contract. And client started requesting unnecessary extensions and giving snags to delay the process as buyers were not buying. 2. Change of various closeout managers also led to delay due to resources demobilisation.	1. There were contractual obligations which had to be followed. 2. Unclear closeout activities and planning gave room to client to take advantage as per the market situation.	F01, F09, F10

4	Completion & approval by clients' FM team of punch list.	NA		
5	Regular handover schedule tracking and record keeping such as MOMs, snags, etc.	Large number of sub-contractors and vendors created tracking difficulty and MOMs were either not circulated or read upon by all the concerned party. Snagging and desnagging activities took time.	1. Record management was poor and stakeholders were lacking urgency. 2. Micro scheduling and planning of snagging activities for different work packages could be improved.	F08, F02,
6	Issuance of partial occupancy certificates after physical completion lead to physical closeout	Delay in obtaining occupancy certificates due to multiple snagging.	Coordination with PMC for flats was not smooth with FM team from client side.	F05, F02, F04
7	Financial closeout and completion (satisfaction) sign offs.	NA	NA	
8	Submission of all the as-built drawings and desnagging reports after verification	Delay in submission of as-built drawings due to large number of on-site corrections in shop drawings.	Multiple punch list with direct change orders led to change in shop drawings and interior finishing drawings.	F01, F10, F02
9	Site clearance: vendors' stores clearance, Debris clearance and cleaning of the site.	Done in scheduled duration but variation was observed in attic stock list.	Lack of supervision and micro planning of each activities were missing due to crashing timeline.	F02, F04, F07, F09
10	Commercial/ Financial Closeout	NA	NA	

1.32. SOP 2: DIVYASREE TOWER- B07, BENGALURU

1.33. Project Brief

This is one of the residential towers (3B + G + 15storeys) project in Bengaluru which is being developed by Divyasree.

The completion of this tower was supposed to done by Sept 2021 and but there was a significant delay during closeout phase of the building.



STAKEHOLDERS	
<b>Client</b>	Divyasree Infrastructure Projects Pvt Ltd
<b>Contractor</b>	Colliers International
<b>Lead Architect</b>	Maithel& Associates Architects Pvt. Ltd.
<b>MEP Consultant</b>	Designtree Service Consultants Pvt Ltd.
<b>Landscape Consultant</b>	Site Concepts International Limited

<b>Contractual completion</b>	<b>September 2021</b>
<b>Actual final completion</b>	<b>March 2022</b>
<b>Delay after substantial completion</b>	<b>6 Months</b>

#### 1.34. Causal Analysis

The Project Management Consultant Colliers International has a defined set of SOP during closeout phase of a project which is further classified into sub- sets with monitoring and tracking process. Each SOP was critically analyzed

and issues were noted which arose during the phase. Inferences drawn from each issue were then relationship has been established with the already recognized casual factors to find the root cause of it, on ground.

SNO	CLOSEOUT SOP FOLLOWED	ISSUES	INFERENCES	CAUSAL FACTORS
1	Preparation, issuing and monitoring of detailed Punch list for each and every package.	Got delayed and improper documentation led to miscommunication and a lot of meetings with stakeholders.	1. Micro scheduling was not done in detail. 2. Poor stakeholder and concerned party management under clients' pressure.	F03, F02, F05, F07, F09
2	Certifying completion of the Punch list.	Client proposed punch list work package wise in the absence of the responsible party. Some inspections happened beyond scheduled date. All the concerned stakeholders' were not present in some snagging activity dates.	1. Planning of closeout activities were not thought of in detail and buffer was very less. 2. Miscommunication and lack of urgency in contractor were observed.	F02, F01, F05, F09
3	Monitor submission and approval of all Project handover documents from the			

	<b>contractors namely:</b>			
	As Built drawings	As- built drawings were not completely prepared by the contractor by scheduled date due to multiple punch list rectification. Contractor demobilized resources during snag rectification period which led to delay.	1. Lack of resources due to poor anticipation about closeout. 2. No. of snag rectifications led to delay and overruns.	F03, F01, F04, F09
	List of tools and tackles	NA		
	Operation & Maintenance Manuals	Third party and statutory approvals of Firefighting and Electrical services got delayed as adequate time was not considered if any fire related changes during final inspection.	1. Statutory approvals delay while obtaining NOC for different services such as firefighting. 2. Micro scheduling error for approvals.	F09, F02, F07
	Test Certificates	NA		
	Guarantee / Warrantee	NA		
	Attic Stock	Timely records were not maintained from start.	Poor documentation & no resource allocation for executing this particular job.	F05, F08
	Training Manuals	NA		
	Statutory approvals and certificates	NA	Inspection by green consultants, might lead to changes. Govt. approvals takes unusual times mostly.	F05, F08, F02
<b>4</b>	<b>Issue of Final Completion Certificates, on behalf of the Client.</b>	Due to pandemic, client tried to stretch the handover phase and some change orders were also issued. Payments got delayed as well.	Delayed due to: 1. Lack of urgency was observed in client as well due to pandemic situation. 2. Multiple punch lists and mismanaged scheduled. 3. Delayed payment from client side due to pandemic and bank issues.	F04, F01, F05, F08, F06, F10
<b>5</b>	<b>Certification and recommendation of</b>	NA	NA	



	<b>Contractor's final bills.</b>		
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1.35. Results

Standard operating procedure during closeout of a project is a very dynamic and project specific process which starts building from the initiation of a project itself. Generally, pre planning and strategies are made concrete during the execution phase the project and project management consultancy plays a very crucial role in this phase as client needs his final product on time with quality and contractor has already gotten

80% to 90% of the entire amount by this time, therefore contractor starts deploy resources (mostly manpower) to other new sites. This scenario has to be planned, controlled and monitored by the PMC to have smooth and effective closeout.

Out of 14 issues listed as per the case example during closeout of the project, percentage of responsible casual factor (directly or indirectly) has been calculated and ranked to get the most critical factors on ground.

Top Factors	Nomenclature	Frequency	%'age
Lack of planning and resource allocation	F02	10	71.42%
Poor stakeholder management	F05	7	50.0%
Unclear SOPs for closeout, in specifications and contractual requirements	F09	7	50.0%
Multiple snag lists (punch lists)	F01	6	42.8%
Technical expertise (Appointment of specialized/ experienced closeout manager)	F04	5	35.8%
Direct change orders from owner/ client	F10	5	35.8%
Leadership of the project team	F07	4	28.6%
Irregular & untimely documentation of contractual closeout	F08	4	28.6%
Role of Quantity Surveyor during final work measurement and billing.	F03	3	21.4%
Delay in payment of work before substantial completion by client	F06	1	07.1%

F09 an F10 has been given relatively less important than what is actually is, in real execution. That is, unclear SOP for closeout and direct change orders

from client play crucial role in the smooth and effective closing of the project both administratively and contractually.

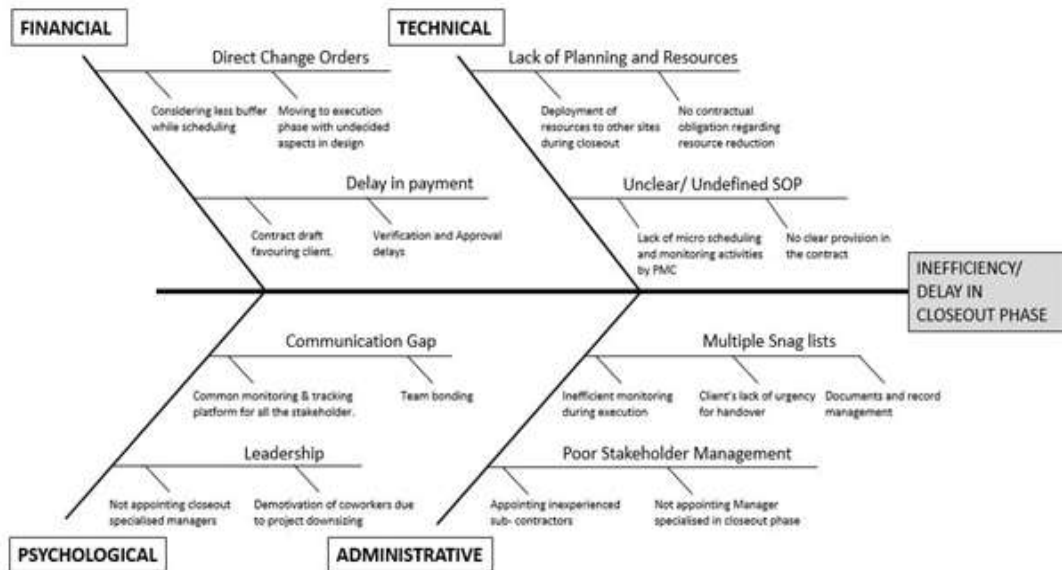


Figure 4.2: Fishbone diagram depiction (RCA)

After casual factor analysis, the factors are then, again verified with the recognized factors in literature and also attempt has been made to find the root cause of the issue arose during particular case specific closeout case. Ishikawa cause and effect diagram, popularly known as fishbone diagram is one of the tools used in root cause analysis.

### 1.36. Validation and strategic mitigation measures

To get the insight on, what all measures are taken by organizations to mitigate such delays or ineffective closeout towards the end of the project and results (shown in table 4.6) suggests that most of the organizations are mitigating it through contractual measure such as retention money and early completion incentives.

Measures	RII	Rank
Retention money	0.8151	1
Early completion incentive	0.8113	2
Penalty for late completion	0.7698	4
Appointing 'closeout phase' specialized Project Manager in the phase	0.8000	3

Table 4.1 Most relevant or used strategies to mitigate delay in closeout phase (Author)

Apparently, during pilot surveys as well, author recorded that retention money and early completion clauses are directly targeted to the psychology of the project management teams and contractor which keep them motivated even in the

last stage of the project. And as results also suggests, few organizations are also appointing 'closeout phase' specialized project manager to conduct the process smoothly and on time.

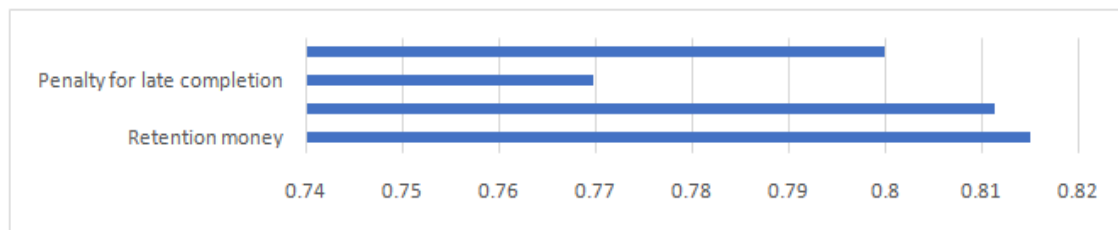


Figure 4.3 Most relevant or used strategies to mitigate delay in closeout phase (Author)

The major tools available for formal closeout of a project are:

- i. **Checklists:** It is the most common closeout program where all the requirement of the client and project are mentioned and circulated to each dept. accordingly to perform their duty.
- ii. **Processes flowchart:** It is the written procedure for obtaining progress and defining all the procedures for closeout jobs on the book.
- iii. **Central filing/ Accountability:** this is to track the progress and check the system in line. All the relevant document should be uploaded or submitted to a common file.
- iv. **Tracking systems:** Tracking all the payouts, change orders, snag lists, etc. electronically by the project managers will help identify the weak areas and progress.
- v. **Standards:** All the outlined and relevant standards must be met by each stakeholder for each project.

### 1.37. Inferences

The recognized casual factor validated through industries' experts and ranked accordingly. The case examples where all the issues and inferences drawn during execution of each closeout SOP has been verified and related with the direct and indirect casual factors (factors which are responsible for those issues). This particular analysis is done to get clearer picture of the actual gap between the considerations of perceived factors and factors actually responsible for the delay during closeout stage. Also, this analysis will help defining mitigation strategies to plan out the closeout stage in an efficient way. Therefore, forming an adaptive framework for closeout, that is being dynamic in nature (project specific).

## V. FRAMEWORK AND CONCLUSION

The entire closeout stage can be planned in three broad stages:

1. Pre- planning stage

2. During closeout stage (track, monitor and control)

3. Post closeout stage

Each will be concluded in this study with an adaptive framework and major recommendations to ensure effective closeout. The tools or programs found out for the effectiveness of closeout phase, can be implemented together and made into adaptive tracking framework which can ensure the smooth closeout.

1.38. Pre- Planning stage

This stage starts at execution phase of the project, where project manager along with all the concerned stakeholders has to plan out in broad terms, the strategies for closing out. The following should be the major considerations during this stage:

- i. Management should ensure the minimum deployment of resources during the closeout stage of the project until all the snag rectifications are done and approved.
- ii. Closeout specialized project manager should be appointed for strategizing the whole process.
- iii. SOPs should be defined with at most clarity for both the client and contractor and regular meetings should be conducted regarding that.
- iv. Clarity of the owner during execution stage itself will ensure minimizing the chances of multiple snag lists, eventually saving cost and time as well.

v. Micro scheduling of each closeout activity is encouraged and also, consolidated tracker must be made and customized project specific for tracking of every task and mitigated all the possible risk.

1.39. During closeout stage

This is the most crucial stage where process of handing over of the facility will be executed. Tracking, monitoring and controlling are the major aspects of this stage. Following are points which must be adhere to, to have an effective closeout-

- i. Consolidated closeout matrix must be prepared which will be adaptive in nature considering the critical casual factors found this study.
- ii. For efficient tracking every stakeholder must give their input data to the matrix regularly about their job. This activity will also come under record and documentation management (even legal aspect), a specialized project manager must be appointed for ensuring this task.
- iii. Tracker must be calibrated with updated schedule regularly to avoid any discrepancy or delay.

1.40. Tracking templates

As found in previous chapter, the tool and techniques to track the progress, mitigate the risk and have a smooth close, following checklists are formed as a part of an adaptive framework:

i. Closeout Summary Matrix

CLOSE OUT MATRIX			
PROJECT			
PROJECT MANAGER			
PLANNED DATE OF COMPLETION OF CLOSE OUT			
ACTUAL DATE FOR COMPLETION OF CLOSE OUT			
ACTUAL % COMPLETED			
Sl No.	Activity	% Completed	Remark
1	Close out meeting		
2	Training to FM team		
3	Pending Works		
4	Snag list		
5	Handing over Documents		
6	Practical Completion		
7	Final Bill		
8	Vendor Stores Clearance		
9	Debris Clearance		
10	Vendor Escalation Matrix - Project		

11	Vendor Escalation Matrix - Service		
12	Asset List		
13	Drawing Register		

ii. Central checklists for tracking ‘training to FM team’ as per the work package

TRAINING TO FM TEAM			
Sl No.	Work Package	Yes / No	Date
	<b>Any specific area or floor</b>		
1	Electrical		
2	HVAC		
3	FAPA		
4	BMS		
5	Chairs		
6	Civil & Interior		
a	Sliding folding partition		
Note: If required by the FM team, more trainings can be incorporated in the above schedule			

iii. Pending works lists, status and accountable dept.

PENDING WORKS					
	SUMMARY				Date
	Total	09			
	Open	0	0%		
	Closed	0	0%		
	Not doable	0	0%		
Sl No	Item	Status	Target / Closure date	Next Action by	Dependency
1					
2					

iv. Snag list or punch list summary (checklist)

SNAGLIST SUMMARY						
S.No	Vendor/ Sub- contractor	Total	Open	Closed	% Completed	
1	Vendor 1		0			
2	Vendor 2		0			
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>		

v. Snag list accountability and deadline table

PROJECT SNAGS									
SL no's	Date/Issue Identified	Area	Floor	Description of Issue	Vendors	Reported By	Parties involved	Status	Remarks
1									
2									

vi. Checklist for all the handing over documents

SN	PACKAGES	VENDOR	HARD COPIES SUBMITTED	PEN DRIVE SUBMITTED	INDEX	DESCRIPTION OPERATING PROCEDURES MAINTENANCE	APPENDICES RECORD	DRAWINGS	COMMISSIONING WARRANTY CERTIFICATE	COMPLETION	TRAINING CERTIFICATE	INVENTORY LIST	KEYS LIST	DO'S & DON'T'S	COMPLETION SUBMITTED TO CLIENT	APPROVAL FROM CLIENT	FINAL HARD COPY	REMARKS
1	Civil & Interiors																	
2	HVAC																	
3	FAPA																	
4	Electrical																	
5	BMS																	
6	Carpet																	
7	Modular Workstations																	
8	Loose Furniture																	
9	NETWORKING-Cabling																	
10	ACS & CCTV Works																	
11	AV Works																	
12	Kitchen Equipment																	

vii. Final billing tracker (work package wise)

FINAL BILL					
Sl No.	Work Package	Vendor	Target Date	Actual Completion Date	% Completed
1	Civil & Interiors				
2	HVAC				
3	Fire Protection & Detection system, Reaction system				
4	Electrical Package				
5	BMS				
6	Carpet				
7	Modular Workstations				
8	Loose Furniture - Café & Pantry				
9	Loose Furniture - Breakout				
10	NETWORKING-Cabling				
11	ACS & CCTV Works				



12	Kitchen Equipment				
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viii. Vendor store and debris clearance checklists defining responsible person dept.

VENDOR STORE/ EXCESS MATERIAL CLEARANCE			
SI No.	Work Package	Responsibility	% Completed
1	Civil & Interiors		
2	HVAC		
3	Fire line safety		
4	Electrical Package		
5	BMS		
6	NETWORKING- Cabling		
7	ACS & CCTV Works		
8	Miscellaneous Project Store		
			0%

ix. Asset and inventory lists

Asset Lists								
SI No	Asset Name	Location	Make	Serial Number	Model Number	DLP Start date	DLP end date	Remarks
1								
2								

x. Drawing register Template

Ref.No.	DESCRIPTION	File Name	Date of Submittal			
			Rev.	Planned	Lead time	Actual submission
<b>TECHNICAL / SAMPLE SUBMITTAL</b>						
FIRE DETECTION SYSTEM						
FIRE PROTECTION SYSTEM						

1.41. Post closeout stage

At this stage, all the stakeholders will sign off from their obligation and all the documentation must be managed and handed over to the client. Records, manuals and documented informations are very crucial for the client and health of the project till defect liability period of the contractor. Also, for the consultancy, all the lesson learned should be documented in a concise but detailed 'project closeout report' and referred while planning SOP for the next project. This will increase their effectiveness during closeout of any project.

1.42. Inferences

The entire standard operating procedure must have adaptive and flexible components to cater the on-site issues then and there. The strategic planning including a formation of tracking and

recording system not only help in effective closeout of the project but also keep it clean and smooth without any misunderstanding. Each template is designed keeping in mind the casual factors for the frequent issues and planned in such a way that, it is adaptive in nature. Therefore, the entire framework can be used by any PMC or executing agency as per their requirement and get the maximum output out of it, when used in an efficient way.

Project managers specialized in closeout phase with his/ her team are the backbone of the whole process because the monitoring and controlling come under their domain.

1.43. Conclusion

Based on the findings, the closeout phase of a project may be safely classified as a vital and under-planned phase. The many elements

impacting project closeouts were discovered and grouped according to: 1) their area of influence, such as psychological, financial, technical, and administrative aspects, and 2) their severity, or effect. Based on the preceding activity, a short list of criteria was produced based on their probable influence on project closeouts. It is reasonable to assume that less experienced professionals undervalue the importance of the closeout phase. This paper might be a valuable resource for project engineers who are just starting out or who have little experience.

This paper can be referred as a resource for entry-level professionals who were unfamiliar with the closeout process. Even if a team member isn't directly responsible for a factor impacting the closeout phase, this template may be a valuable tool for alerting the appropriate department so that the impact of that issue can be reduced. As it has already been established that compiling a rigid framework will not work as every project is unique and have dynamic angles, therefore improvisations can be made or defined in a flexible way to carry the closeout process smoothly and adaptively as per projects requirements.

Furthermore, the study can be taken forward to analysis the individual impact of each factor over a project and its severity to mitigate the risks involved.

## REFERENCES

- [1]. Al- Kharashi, A., & Skitmore, M. (2009). Causes of delays in Saudi Arabian public sector construction projects. *Construction Management and Economics*, 27(1), 3–23. <https://doi.org/10.1080/01446190802541457>
- [2]. Basu, C., Paul, V. K., & Matt Syal, M. G. (2017). Innovations for Energy Efficiency Retrofitting Financing in Construction Sector: Indian Perspective. *International Conference on Sustainable Infrastructure 2017*, 199–210. <https://doi.org/10.1061/9780784481202.019>
- [3]. Basu, C., Paul, V. K., & Syal, M. G. M. (2019). PERFORMANCE INDICATORS FOR ENERGY EFFICIENCY RETROFITTING IN MULTIFAMILY RESIDENTIAL BUILDINGS. *Journal of Green Building*, 14(2), 109–136. <https://doi.org/10.3992/1943-4618.14.2.109>
- [4]. Carson, C. W., Potter, J. C., Sanders, M. C., & Stauffer, J. J. (2009). The Great Debate: Planning and Scheduling From Substantial to Final Completion. 7.
- [5]. Chan, A. P. C., Scott, D., & Chan, A. P. L. (2004). Factors Affecting the Success of a Construction Project. *Journal of Construction Engineering and Management*, 130(1), 153–155. [https://doi.org/10.1061/\(ASCE\)0733-9364\(2004\)130:1\(153\)](https://doi.org/10.1061/(ASCE)0733-9364(2004)130:1(153))
- [6]. Durdyev, S., & Hosseini, M. R. (2019). Causes of delays on construction projects: A comprehensive list. *International Journal of Managing Projects in Business*, 13(1), 20–46. <https://doi.org/10.1108/IJMPB-09-2018-0178>
- [7]. Fahri, J., Biesenthal, C., Pollack, J., & Sankaran, S. (2015). Understanding Megaproject Success beyond the Project Close-Out Stage. *Construction Economics and Building*, 15(3), 48–58. <https://doi.org/10.5130/AJCEB.v15i3.4611>
- [8]. George, C. (2018). Understanding the Concept of Project Termination in the Management of Projects. 9(3), 5.
- [9]. Gupta, R. K., Paul, V. K., & Solanki, S. K. (n.d.). Optimization of Project Progress Using 3D Laser Scanning Technique. *INTERNATIONAL JOURNAL OF ARCHITECTURE AND INFRASTRUCTURE PLANNING*.
- [10]. Havila, V., Medlin, C. J., & Salmi, A. (2013). Project-ending competence in premature project closures. *International Journal of Project Management*, 31(1), 90–99. <https://doi.org/10.1016/j.ijproman.2012.05.001>
- [11]. Johnson, T. A., Michaels, D. A., Sturgill, R. E., & Taylor, T. R. B. (2017). Streamlined Project Closeout for Construction at KYTC [PDF]. <https://doi.org/10.13023/KTC.RR.2017.12>
- [12]. Kasana, V., Paul, V. K., & Solanki, S. K. (n.d.). Framework for Rehabilitation of Buildings to Improve Health, Hygiene, and Comfort of Occupants. *INTERNATIONAL JOURNAL OF TOWN PLANNING AND MANAGEMENT*.
- [13]. Kaul, V. (2014). EXCESSIVE DELAYS IN CLOSEOUTS CAN BE REMOVED WITH THE ADAPTATION OF BETTER PRACTICES. 116.
- [14]. Kifle, Z., & Abagissa, A. J. (2017). The Assessment of Addis Ababa Housing Development project with particular reference to delays and constraints in its implementation: The Case of HDPO. 108.
- [15]. Kumari, N., Sidana, T., Paul, V. K., & Solanki, S. K. (n.d.). Analysis of Smoke Production and Movement in Shopping

- Malls/Centers. INTERNATIONAL JOURNAL OF TOWN PLANNING AND MANAGEMENT.
- [16]. Lock, D. (2007). Project management (9th ed). Gower.
- [17]. Paul, V. K., & Basu, C. (2016). Scenario Planning and Risk Failure Mode Effect and Analysis (RFMEA) based Management. *Journal of Construction Engineering and Project Management*, 6(2), 24–29. <https://doi.org/10.6106/JCEPM.2016.6.2.024>
- [18]. Paul, V. K., Solanki, S., & Dasgupta, R. (2021). Post Pandemic Impact on Planning Of District Hospitals in India. *International Journal of the Built Environment and Asset Management*, 2(1), 1. <https://doi.org/10.1504/IJBEAM.2021.10043515>
- [19]. Rogers, J. (2012). Opportunity Lost: Mismanagement of the Closeout Phase of Construction Projects. 47.
- [20]. S., G., & Kumar, V. (2019). User centric facility maintenance model for public housing. *Facilities*, 37(11/12), 839–859. <https://doi.org/10.1108/F-09-2018-0110>
- [21]. Saeed, S. A. A. (2009). DELAY TO PROJECTS – CAUSE, EFFECT AND MEASURES TO REDUCE / ELIMINATE DELAY BY MITIGATION / ACCELERATION. 137.
- [22]. Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, 25(5), 517–526. <https://doi.org/10.1016/j.ijproman.2006.11.007>
- [23]. Sanvido, V. E. (1988). Conceptual Construction Process Model. *Journal of Construction Engineering and Management*, 114(2), 294–310. [https://doi.org/10.1061/\(ASCE\)0733-9364\(1988\)114:2\(294\)](https://doi.org/10.1061/(ASCE)0733-9364(1988)114:2(294))
- [24]. Seshadhri, G., & Kumar Paul, V. (2018). User Satisfaction Index: An Indicator on Building Performance. *Journal of Civil Engineering and Structures*, 2(1), 14–33. <https://doi.org/10.21859/jces-02012>
- [25]. Seshadhri, G., & Paul, V. K. (2018). MEASURING SATISFACTION WITH USER REQUIREMENT RELATED BUILDING PERFORMANCE ATTRIBUTES: A QUESTIONNAIRE. 9(1), 14.
- [26]. Shay, Z. B. (2019). FACTOR THAT AFFECT CONSTRUCTION PROJECT CLOSEOUT DELAY IN 40/60 SAVING HOUSES PROJECT OF ADDIS ABABA. 72.
- [27]. Sreekumar, A., Paul, D. V. K., Solanki, S. K., & Dua, S. (n.d.). Sustainable Retrofit for Adaptive Building Reuse—A Facility Management Approach for Highlighting and Cataloguing Deficiencies for Retrofit Decision Making. 17.
- [28]. Stoshikj, M., Kryvinska, N., & Strauss, C. (2013). Project Management as a Service. *Proceedings of International Conference on Information Integration and Web-Based Applications & Services - IIWAS '13*, 220–228. <https://doi.org/10.1145/2539150.2539171>
- [29]. Yadav, P., Khursheed, S., Solanki, S. K., & Paul, V. K. (n.d.). A Review of Retrofitting Techniques of Masonry Structures. 9.