

ANALYSIS ON FACTORS INFLUENCING COST OVERRUN IN CONSTRUCTION PROJECTS

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ABSTRACT: Cost overruns in construction projects are considered one of the major issues globally, without any control or solution for the last 70 years. The construction industry is the second largest sector next to Agriculture in India. This industry forms the backbone of the Indian Economy. It not only provides infrastructure for all other industries but is also one of the largest single sectors in the economy on its own, according to gross domestic product (GDP). India's new economic policy has opened up new avenues and vistas for the development and growth of various sectors. It is essential that infrastructure development should keep pace with the developmental activities of the other sectors. This has resulted in a lot of pressure on the construction activities. The cost refers to the predetermined amount of money that the client has decided to allocate for the purpose of constructing or obtaining the desired facility (Chitkara, 2011). Cost overrun refers to the disparity between the actual costs and the projected costs, expressed as a percentage of the estimated cost, with all expenses measured in constant prices. Actual costs refer to the expenses that have been recorded and actually incurred, as decided upon the completion of the project. Estimated costs refer to the budgeted or expected expenses that are determined at the time of project approval. These costs are usually comparable to the costs outlined in the business case for the project (Lee, 2008).

INTRODUCTION

The cost of a work unit is composed of multiple cost components. The cost aspects encompass labor costs, material costs, plant and machinery costs, administration costs, and other expenses. To determine the expenses related to a certain activity, building costs are classified as either "Direct costs" or "Indirect costs" also known as "Overhead costs". Costs that can be directly attributed to a certain activity or project. Direct costs are expenses that may be directly attributed to a particular activity or task that is being performed or generated. The direct cost of a permanent work item is calculated by adding the direct material cost, direct labor cost, and any direct charges.

Direct material costs encompass all expenses associated with materials that are integrated into the permanent structures of the project. Direct labor costs encompass the total charges for the acquisition, upkeep, and salaries of all types of personnel engaged at the project site for the completion of a certain task. Other direct expenses encompass all additional costs incurred for services provided that can be directly linked to and easily associated with the completion of a specific task or project. Overhead Expenses: Indirect costs encompass all expenses that are related to a particular project but cannot be directly linked to the execution of a single task or work package. Indirect costs encompass any expenses that are not classified as direct costs.

Construction Project Management in India
Construction projects are becoming more complex and highly-risky due to cost overrun. These overruns often

results in either delay or incompleteness or other such difficulties. The various factors that contribute to the failures can be classified as

- (i) External and (ii) internal.

The external items, such as political impact, natural calamity etc, are beyond our control. Hence the internal factors are only considered for this study, such as human – related factors, project related factors, project procedures and project management actions to find out the variable influencing the cost overrun in the construction on project (Albert P.C. Chan et al, 2004).

Cost Management in Construction Project

Cost management is the process used to control the cost of the project while maintaining the scope of all the deliverables. Therefore the cost management process (CMP) is important to control the expenditure at every stage of a project from its inception through its development, design, execution, final payment and closure of a project. Cost management or cost control, cannot act independently without the integration with time schedule and quality. Cost and scheduling are closely interrelated because they share a lot of common data in their controlling process.

Cost management also includes resource planning, estimating. The use of resources like men, money, machines, materials, etc. emphasizing on time management is probably the ideal cost management. In construction cost control may be implemented from the stage of planning, estimating, designing, tender

bidding, materials purchase, machinery usage, financial allocation, budgeting and monitoring, men and materials handling etc. Cost is the fundamental resource of the project. Cost overrun occurs if the project manager is unable to control the project activities efficiently from inception to completion. Ineffective coordination between the client, architects, project managers, contractors and engineering team also contribute to cost overrun. As per Darshi et al (2001) Construction coordination is an important function in the building process.

IMPORTANCE OF COST ESTIMATION IN CONSTRUCTION PROJECTS

Construction projects consist of multiple activities that are interconnected and interdependent. The contemporary age is characterized by dynamic and fluctuating surroundings that impose a range of constraints, including legal, financial, environmental, ethical, and logistic considerations. Individuals engage in economic, technical, and social interactions within their surroundings, as well as with various organizations. These initiatives utilize a significant amount of resources that are accompanied by inherent challenges, risks, and uncertainties. At the inception of a project, before to engaging in any design activities, there exists a dearth of comprehensive knowledge on the project. Consequently, it becomes imperative to undertake an initial assessment in order to ascertain the approximate details necessary for evaluating the economic viability of progressing with the project. A conceptual estimate is commonly referred to as a top-down, order of magnitude feasibility analogous or preliminary estimate in academic discourse.

Sustainable project planning is currently experiencing increased recognition and adoption, mostly driven by the escalating resource limitations, environmental degradation, and waste production associated with the construction sector. Currently, construction authorities are actively promoting sustainable construction practices through the implementation of resource-efficient and environmentally friendly construction projects.

Efficient resource management in construction project planning necessitates meticulous planning, diligent monitoring, and effective resource allocation, complemented by accurate conceptual cost modeling. The construction project is a high-stakes undertaking with predetermined, time-bound performance goals. No activity can be carried out without prior scheduling if appropriate resource planning and procurement are absent. Always, project managers must make concrete

decisions based on diverse scheduling requirements, including resource utilization and resource constraints. Time and expense are wholly dependent on the availability of resources. The required time can be determined by allocating the productivity of the resources utilized for the activity. The optimal combination of resources for a construction project depends on a manager's ability to recognize the interdependencies between the various resources.

Occasionally, due to unforeseen circumstances, the durations of the duties may extend beyond those specified. The execution of a construction project successfully depends not only on the quality and quantity of labor, but also on the availability of resources. Every endeavor activity requires a certain amount of resources. Each activity is assigned a specific resource and must be completed within the allotted time frame; failing to do so could negatively impact the overall duration of the project. Consequently, resource constrained analysis was employed in this study. Cost estimation is a portion of the initial project feasibility analysis and involves a series of efforts to predict the project's costs. In existing practice, construction practitioners have recognized the prominence of early planning to the ultimate outcomes of the project for resource efficient construction projects. During the initial stage of project formulation, a Conceptual Cost Estimate (CCE) is created to evaluate the economic viability of proceeding with the project. While producing conceptual cost estimates, planning engineers consider a number of intricate factors that determine the project's cost. In contemporary times, the construction sector frequently encounters the challenges of cost overrun and cost escalation. The reliable estimate of the conceptual cost of a building project is a crucial factor in ensuring its successful completion. As a result, project managers place greater attention on conceptual cost estimation. The modeling of conceptual cost is crucial for the effective completion of construction projects, and hence, a variety of methodologies are employed in this regard.

Conceptual estimating is a method characterized by its inherent imprecision, as it relies on incomplete or unavailable data within a constrained timeframe. The conceptual cost is a discipline that encompasses both artistic and scientific elements in the estimation of the costs associated with previous work. The artwork involves the process of conceptualizing a project and meticulously executing each individual component. The conceptual cost refers to a comparative analysis research that examines past and future projects by retrieving cost data from previous projects and changing them to

account for new conditions. The second attribute of conceptual cost pertains to the precision and reliability associated with the extent of information provided by the project scope. Another significant aspect to consider is resource-constrained tasks. Currently, there is a widely accepted notion that as the amount of asset specification increases, the accuracy of cost estimation also improves, resulting in decreasing levels of inaccuracy.

FACTORS CONSIDERED FOR COST OVERRUN

Cost overrun in construction projects refers to the situation where the actual cost of a construction project exceeds the initially estimated or budgeted cost. This can occur at any stage of the project, from initial planning to completion, and can be caused by a variety of factors. Here are some common reasons for cost overruns in construction projects:

1. **Inaccurate Initial Cost Estimates:** Sometimes, cost overruns stem from inaccurate or unrealistic initial cost estimates. Factors such as incomplete project scope definition, inadequate market research, or lack of experience in estimating costs can contribute to this issue.
2. **Scope Changes:** Changes in project scope during construction can lead to cost overruns. Additional requirements, modifications, or unforeseen circumstances can necessitate extra work and resources, impacting the budget.
3. **Unforeseen Site Conditions:** Unexpected conditions at the construction site, such as poor soil quality, archaeological finds, or environmental concerns, can necessitate changes to the project plan and incur additional costs.
4. **Market Fluctuations:** Changes in market conditions, including fluctuations in material prices, labour costs, or interest rates, can affect the overall cost of a project compared to the original estimates.
5. **Delays and Time Overruns:** Construction delays can increase labour, equipment, and other associated costs. Delays may result from weather conditions, labour strikes, permitting issues, or unexpected technical challenges.
6. **Inadequate Risk Management:** Failure to identify, assess, and plan for potential risks adequately can lead to cost overruns. Effective risk management is crucial to mitigate the impact of unforeseen events.

7. **Contractual Disputes and Legal Issues:** Disputes with contractors, suppliers, or legal problems can lead to delays and additional expenses related to legal fees, settlements, or changes in project execution.

8. **Inefficiencies and Poor Project Management:** Inefficient project management, lack of coordination among project stakeholders, or inadequate resource allocation can contribute to cost overruns.

9. **Inflation and Economic Factors:** Changes in economic conditions, inflation, or fluctuations in currency values can affect the costs of construction materials, labour, and equipment.

10. **Lack of Expertise and Experience:** Inexperienced project teams or contractors may underestimate the complexity of a project, leading to inaccurate cost estimates and eventual cost overruns.

To mitigate cost overruns, effective project management, accurate and detailed cost estimation, thorough risk assessment, clear project scope definition, and continuous monitoring of the project's progress and expenses are essential. Additionally, having contingency plans and sufficient reserves in the budget for unexpected events can help mitigate the impact of cost overruns on a construction project. Charlel et al (1990) discovered that a cost overrun rate of 1 to 11% is more likely to occur on larger projects than smaller ones. From initiation to completion stage of a construction project there are different stages and activities quantitatively and qualitatively. So this study concentrates on both quantitative and qualitative analyses. As far as the different quantitative activities, the Cost Management ensures the resources planning of people, materials and equipment and what quantities of each should be used to perform project activities. So, the Project Cost Management is thus concerned with the cost of the resources needed to complete various project activities.

Cost control processes are gradually applied in Indian Industry because of growing question cost awareness (CII 1994, Dissanyaka 1999). In addition to the above, the cost management of various activities is possible only when efficient Project Managers are involved. Sophisticated Project Cost Management tool along with all management knowledge areas is essential for the cost control of a construction project. The Project Managers are the key stakeholders in a Construction Project and they are analysed qualitatively. Role of Project Management Consultants is very important in construction industry (Gandage 2007). Okpala et al

(1988) identified 20 variables that could cause cost overrun and seven other variables that could result in the escalation of construction costs without necessarily causing delay. Therefore both quantitative and qualitative analyses have been carried out in this research by collecting data through various survey questionnaires, by conducting personal interviews and the lacuna in various selected project process levels is identified.

IDENTIFICATION OF THE PROBLEM

In India, the construction activities are increasing day by day to improve the infrastructure facilities like roads, bridges, flyovers, IT Buildings etc. When the budget outlay for the construction activities is huge, even a little savings will make millions of rupees. For developing countries like India, achieving an economy by avoiding cost overrun is very helpful. Small improvements discovered in research for cost reduction will be of great value for the effective management of the construction industry.

SCOPE AND OBJECTIVES

The objective of the research is to evaluate the factors that contribute to cost overruns in construction projects.

- ✓ To determine the factors responsible for cost overruns and assess their respective significance.
- ✓ To obtain perspectives on these factors from key stakeholders in the construction sector, specifically contractors, clients, and consultants.
- ✓ To assess the degree of correlation between the rankings of the groups of respondents.
- ✓ To prioritize the sources of cost overrun based on their significance.
- ✓ To determine the frequency of occurrence for each of these reasons.
- ✓ To evaluate the magnitude of the effect these reasons will have on the overall project expenses.

1.6 LIST OF CRITICAL FACTORS

- ❖ Incomplete design at the time of tender.
- ❖ Additional work at owner's request.
- ❖ A change in owner's brief.
- ❖ Lack of cost planning/monitoring during pre-and-post contract stages.
- ❖ Site/poor soil conditions.
- ❖ Adjustment of prime cost and provisional sums.
- ❖ Re measurement of provisional works.

- ❖ Logistics due to site location.
- ❖ Lack of cost reports during construction stage

LITERATURE SURVEY

This chapter will focus on theoretical, empirical studies and conceptual framework to study the meaning, delay and overrun causing factors on construction projects. It presents the most important factors which cause delay in construction projects.

The construction industry is critical to any country's growth. Buildings, highways, and bridges can be used to calculate a country's economic development (Fugar & Agyakwah Baah (2010). Various parties, procedures, different phases and steps of work, and a great deal of feedback from both the public and private sectors are all involved in the implementation of a construction project, with the main goal of getting the project to a successful conclusion Wang (1994). The success in carrying out construction project creation is measured by the quality of the respective parties' managerial, financial, technological, and organizational efficiency, while taking into account the related risk management, the market climate, and economic and political stability (Duncan 1990). As construction becomes more complex, Wang (1994) claims that a more sophisticated approach is needed to deal with initiating, preparing, funding, designing, authorizing, implementing, and completing a project.

According to (Duncan 1990) Contractors play a critical role in the completion of construction projects. Their key responsibilities begin when the project hits the implementation point, which is when the project's actual work is completed. When it comes to the building sector, project success is crucial. Client satisfaction and on-time completion are often used as performance indicators. The effectiveness of construction projects is determined by the ability of the construction project manager to fulfill his job functions with the expected efficacy.

A "construction project" refers to a specialized construction mission that involves the creation of a construction facility or service. It is characterized by its high value and time constraints, and is undertaken with established performance objectives that are described in terms of quality. The factors that need to be considered include the specification, the time required for completion, the budgeted cost, and any other limitations that have been established (Chitkara, 2011). Cost is a fundamental factor that can effectively characterize a construction project, among the five primary factors.

Additional factors include the scope, quality, resources, and completion time. The five parameters are interdependent, meaning that each parameter is a function of the others.

The assessment and harmonization of the interdependencies among the five project parameters is a complex procedure. However, within a single project, the extent and excellence of work, in terms of both quantity and specifications, are explicitly defined and these parameters are not subject to alteration (unless there is a significant change in the project's scope). Resources and costs are directly tied. Hence, in this particular scenario, time, cost, and scope are fundamental variables for a given level of quality.

The characteristics mentioned are interconnected and must be maintained in equilibrium in order to efficiently and successfully achieve the project aim, even in dynamic contexts (Chitkara, 2011). In the present day, even a small increase in costs can completely eliminate the profit from a job, and ongoing cost increases in many of a company's projects can result in bankruptcy (Akinci & Fischer, 1998). Organizations encounter a significant obstacle in managing project budgets throughout the duration from project inception to construction completion. Accurate cost estimates that consider project scope, economic conditions, community interest, and macroeconomic variables establish a baseline cost for management to enforce discipline in the design process. Successful project delivery under budget necessitates an accurate initial estimate, adherence to project management principles, and an understanding of potential cost escalation causes (Shane et al., 2009). This requires identifying the pertinent variables and reasons that result in cost overruns.

According to Azeb (2016) a stakeholder is a person or community who has a stake in, or can affect, the construction project's success, whether they are within or outside the project. Construction projects may have a variety of stakeholders, but for the purposes of this article, the stakeholders are limited to contractors.

In the words of Turner (1999), a project is an endeavor in which human, monetary and fabric assets are organized in a novel way to embrace different scope of work, of given specification, inside limitations of cost and time, so as to realize advantageous alert characterized by quantitative and qualitative objectives.

As defined in A Guide to the Project Management Body of Knowledge (PMBOK® Guide, 2000), a project is a

temporary endeavor embraced to form a different product or service. Temporary implies that every project has a definite starting and a definite ending. Unique means that the item or service is diverse in few recognizing way from all other items or services.

Projects are attempted to fulfill targets by creating deliverables. An objective is defined as result toward which work is to be coordinated, a key position to be achieved, a purpose to be accomplished, a result to be gotten, an item to be produced, or a service to be performed. A deliverable is defined as any unique and verifiable product, result, or capability to perform a service that is needed to be produced to complete a process, phase, or project. Deliverables may be tangible or intangible. Projects are attempted at all organizational levels. A project can contain a single individual or a group. A project can contain a single organizational unit or different organizational units from numerous organizations and their time ranges from a few weeks to more than five years. Projects are basic to the realization of the performing organization's commerce procedure since projects are a means by which a plan is implemented. A project has unique characteristics. The primary characteristic of a project is one-time-activity which the core objective is to solve problems or to grasp an opportunity. Moreover, have starting and ending point. The success of a project is highly affected by the involvement of a stakeholder. So, projects need to be managed carefully. It is the roll and responsibility of a project manager to manage the project (PMBOK 2000)

There are several different meanings that represent various industry practices. Pre-feasibility validation of concepts; feasibility (detailed investigation of viability); design; contract (procurement); implementation; commissioning; handover and service are the widely agreed steps.

The four broad, generic project phases (common alternative terms are shown in parentheses), as advocated by Archibald & Voropaev (2003), are widely accepted:

- Concept (Beginning, finding, and choosing.)
- Definition (feasibility, manufacturing, demonstrating, prototyping, and quantification.)
- Execution (As well as design/build/commission, installation, and testing, implementation, realization, production, and deployment.)

- End of the line (Finishing, including post-completion assessment.)

Dividing a large project into manageable chunks simplifies the difficult task of project management. These chunks are referred to as project phases, which can be further divided into sub-phases, and a compilation of these phases is referred to as a project life cycle. The completion of one or more deliverables marks the end of each project process. Despite the fact that many project life cycles have similar step names and need similar deliverables, few are identical.

The majority of them have four or five stages, but some have as many as nine. Project life cycles can differ for sub-projects within larger projects.

Importantly, these phases are not always consecutive in nature but are more simultaneous. Some representative project life cycles have been proposed by researchers, such as the waterfall model and Muench et al. al's spiral model for the software development life cycle, Morris' (1994) building project life cycle, and Murphy's (1989) representative life cycle for a pharmaceutical project.

According to Kulkarni et al. (2004), projects with a longer lifecycle are more likely to be successful. Depending on the functions, it is divided into several stages. The three well-known phrases are used for ease and simplicity:

- Procurement phase: From inception to the financial closure and beginning of works (tendering; dealing with governments, lenders, insurers, pressure groups, experts)
- Execution phase: Execution of the Project (site installation till routine processes are reached, significant completion)
- Operation and handover phase: From the start of major construction to the end of the defect liability span and handover.

In each phases of a project life cycle needs proper way of management because to say project is successful each phases of the cycle must be monitor and control properly. To do this the project manager need to have a skill and knowledge of management and use different tools and techniques.

Project Management
Project management is the application of knowledge, skills, tools, and techniques to project activities to meet

the project requirements. Project management is accomplished through the suitable application and integration of the project management processes identified for the project. Project management empowers organizations to execute projects successfully and efficiently. PMBOK Guide (2017)

According to Kerzner (2009), project management is the organizing, arranging, directing, and managing of company resources for a relatively short-term mission with clearly defined goals and objectives. Project management criteria are influenced by the project's size, scope, urgency, importance, and novelty. Independent businesses, particularly those vying for the same resource, have more stringent requirements. [Jose et al 2018]

According to the project management handbook, a project has four processes: are initiations to planning, planning to controlling, controlling to closing as show in the figure below

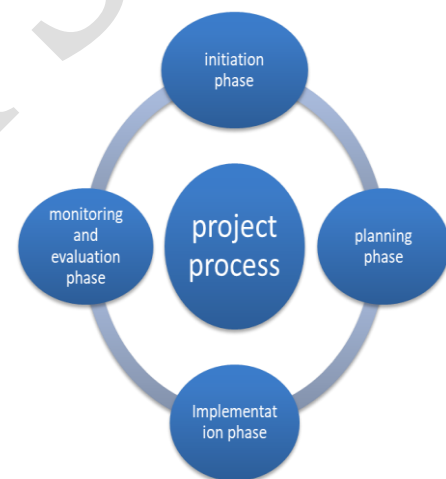


Figure 2.1. Project process source (Odeh, et al 2021)

Project management knowledge areas

According to A Guide to the Project Management Body of Knowledge (PMI, PMBOK® Guide, 2000), a project is a temporary undertaking undertaken to create a new product or service. The term "temporary" means that each project has a start and finish date. A product or service that is "special" is one that stands out from all other projects or services in some way. According to PMI (2013), each project discusses ten project management expertise areas, which represent a range of competency skills and processes that the PM must properly utilize

during the life cycle (Richardson, 2015). The following are some examples:

Project time management:-The time management process includes the procedures for monitoring the project's timely completion.

Project time

The time it takes to complete a project from start to finish, from site handover to completion, according to Sunny and K. Baker's 2003 definitions. The word "duration" refers to the time it takes to complete a project from start to finish, which is usually expressed in days. The most important aspect of the procedure is calculating the length of duties. Clough describes it as the project's duration on the contract's due date, or the provisional completion dates required for phases of the work, according to Clough, 2000. A housing project's failure to finish on time can be caused by a number of causes, both predictable and unpredictable.

To complete a project on time and on budget, each phase of the design and implementation process, from the feasibility assessment to the contractor handing over the finished project to the client, must be meticulously planned to avoid delays, disagreements, and unexpected additional costs. FIDIC is an acronym for the International Federation of Insurance Companies (FIDIC, 2005).

Project Time management

Project time management is the effective and efficient use of time to allow project execution, which starts with project planning, scheduling, and deadline monitoring. The processes that must be followed to ensure that the project is finished on time are referred to as project time management (Jemal, 2015).

The following are brief summaries of the major project time management processes as described by the PMBOK. Activity definition; determining the precise tasks that must be completed in order to achieve the various project deliverables. Activity sequencing; Interactivity dependencies must be identified and recorded. Activity duration estimating; calculating the number of work periods required to complete individual activities. Schedule development; analyzing activity sequences, activity durations, and resources requirements to create the project schedule. Schedule control; controlling changes to the project schedule. Project management tools and techniques Project management methods are mainly intended to apply experience, knowledge,

resources, and techniques to organize projects in order to meet project goals (PMI, 2013). In the literature, the importance of project management techniques and tools in achieving project objectives and expectations has been well established (Milosevic, 2003, Murphy and Ledwith, 2007). Project management principles, for example, have been shown to be extremely useful in managing and controlling project operations (Murphy and Ledwith, 2007) some of the tools and techniques described and discussed are listed below.

Bar Chart: -

It's the most straightforward way to plan, organize, and manage a project. It graphically or tabulated displays the regular and cumulative costs over a specified time period. The general contractor creates a bar map when a project with routine completion or consistent results is awarded. Each bar represents the beginning, duration, and completion of a particular project section. When the bars are added together, they form a project timeline.

Critical Path Method (CPM):-

It is a tool for determining the amount of scheduling flexibility on the logical network paths within the schedule model and estimating the minimum project time. By conducting a forward and backward pass analysis via the schedule network, this schedule network analysis methodology measures the early start, early end, late start, and late finish dates for all operations without consideration for any resource limitations. (PMBOK, 2004). Start relationship, the activities on nodes (AON) or boxes network mechanism goes beyond the critical path approach by including other interactivity relationships such as Start-to-Start (SS), Start-to-Finish (SF), and Finish-to-Finish (FS). It also allows "lags" or "leads" (negative "lags") to be added between tasks.

Definitions of Time Overruns

One of the most serious problems in the construction industry is time overrun. Time overruns occur with any construction project, and the magnitude of these delays varies widely from actual costs are those that are both actual and paid for. one project to the next. It is important to determine the exact causes of time overruns in order to minimize and avoid delays in any construction project. Construction projects that are not completed on time are known as time-overrun projects. According to (Naveenkumar and Prabhu) (2020) Time overrun is described as a delay in the completion of a project that can be traced back to the contractors.

According to Scott (1991), time is the amount of time it takes to complete a project according to the timeline. The length of a project is determined by its design, form, and size. Quality is often related to time, and it is impossible to obtain high quality in a short period of time. In this thesis, delay is defined as the time taken to complete the project beyond what was originally planned.

The process of project cost control starts with the selection of the owner's goals and ends when those goals are reached. Similar study revealed significant delays in construction projects (Zinabu, 2016). Different factors make it difficult to maintain effective time management. According to Olawale and Sun (2010), the following are the top five factors that obstruct successful project time management, in order: Changes in design, inaccurate project time/duration estimates, job difficulty, project risk and uncertainty, and poor performance by subcontractors and nominated suppliers are all factors to consider.

Kasimu and Abubakar (2012) discussed a delay study they conducted in the Nigerian construction industry, identifying the top five factors that affect delay in ascending order as improper preparation, lack of effective communication, design errors, steel and concrete shortages, and slow decision making.

Mengistu (2010) argues that project controlling supporting techniques and software are not well implemented in the construction sector for the management of real and planned operations, and emphasizes the importance of project personnel training. Similarly, Abadir (2011) discovered that project time management is the most important of the project information areas in with just 24% of projects handled well.

The term "delay" has been described in a variety of ways by numerous academics. Delays are defined as events or occurrences that affect the time required to complete a particular task. Assaf and Al-Hejji (2006) defined construction delay as the time over run either beyond completion date specified in a contract or beyond the date that parties agree upon for delivery of a project .

It is slipping over its planned schedule and is considered as common problem in construction projects. Delay was also defined as an —act event which extends required time to perform or complete works of the contract manifests itself as additional days of workl by Zack (2003).

Construction delays can be described as the late completion of work relative to the scheduled or contract

schedule (Kang sikwei (2010). Pickavance Keith (2005) describes the term delay as anything occurring at a later time than anticipated, intended, defined in a contract or beyond the deadline that the parties decided upon for the completion of a project. Construction delay is defined as the times overrun either ahead of end date specific in a contract.

A project is said to be delayed if it takes longer than expected and lags behind schedule. Owing to the delay in building, the owner will lose money due to lower efficiency, a rentable void, or dependence on existing facilities. Longer work periods cause construction delays, which affect contractors by increasing overhead costs, material costs, and labor costs through price increases. Delay is described as causing things to happen later than planned or failing to act in a timely manner (Assaf and Al-hejii, 2006).

In another report, Mohammed (2012) described construction project delay as the difference between the baseline construction plan or contract schedule and the actual progress or completion of work. In general, the above definitions of delay can be summarized as time extension, work slowing down, project slipping, beyond completion date, beyond date of agreement, and late in progress over the baseline schedule.

Type of delay

Delays are almost always unavoidable in construction projects that must be finished according to a schedule. Delays can be classified into two groups in terms of responsibility: excusable and non-excusable delays (Raykar and Ghadge, 2016). These two main categories of delays can be further classified into six types of delays: compensable, non- compensable, concurrent, non-concurrent, essential, and non-critical. Delays can take many forms (Vidalis et al, 2002 as cited in Al-Najjar, 2008). On the project phase, the types of delays may come from both internal and external sources. The owner's internal causes of delay are among the internal causes of delay. External causes of delays originate from outside of construction projects.

Excusable and non-excusable delays

There are two types of delays: excusable and non-excusable. An excusable delay is one caused by an unforeseen incident outside the control of the contractor or subcontractor. There are two types of delays: compensable and non-compensable. If the delay is considered compensable, the contractor may be entitled to additional financial compensation as well as additional

project time. When non-compensated excusable delays arise, the contractor is given additional time but not additional money for the additional work done. Excusable delays are referred to as "force majeure" delays and are often referred to as "acts of God" because they are not the fault or liability of any one person. Most contracts enable the contractor to request an extension of time, but not additional money, in the event of unavoidable delays. General labor strikes, explosions, floods, and Acts of God, according to Mustafa (2008), are all examples of excusable delays. Non-excusable delays are those that occur due to circumstances outside the contractor's control or that are predictable. There are only a few instances of unforgivable delays. Unfair labor practices may also cause construction projects to be delayed.

2.1.8.2 Compensable and non-compensable delays

Excusable delay can be divided into compensable and non-compensable delay. Delays that are compensable are unforeseeable and beyond the contractor's influence. Both time extensions and extra payments are available to the contractor. The administration, direct modifications, job suspension, and critical criticism are all possible causes (Raykar and Ghadge, 2016). In non-compensable delay, neither the owner nor the contractor is responsible for delay.

SUMMARY FROM LITERATURE STUDIES

- ✓ Cost overruns in construction projects are a common issue that can have significant financial and operational implications.
- ✓ A vast body of literature addresses this topic, offering insights into its causes, consequences, and potential mitigation strategies.
- ✓ The primary factors that contribute to cost overruns in projects, which may be controlled. These factors include, but are not limited to:
 - ✓ Insufficient project formulation: Insufficient field inquiry, inadequate project information, inaccurate cost estimates, lack of expertise, inadequate project formulation and feasibility study, inadequate project assessment resulting in wrong investment decisions.
 - ✓ Inefficient implementation planning: Insufficient time allocation, inadequate resource allocation, inadequate equipment supply planning, failure to anticipate inter-linking issues, lack of organization, and inadequate cost planning.

- ✓ Inadequate contract planning and management: Insufficient pre-contract measures and inadequate post-award contract management.
- ✓ Inadequate project management throughout implementation: Insufficient and inefficient operations, delays, alterations in the scope of work and location, and issues related to law and order.

RESEARCH DESIGN AND METHODOLOGY

Cost overruns in construction projects can be attributed to various factors. Each instance of cost overrun has a unique frequency and effect on the final project cost. Certain reasons may occur with high frequency, yet their effects on cost may be quite mild. While certain causes may occur seldom, their consequences can be significant. Hence, it is imperative to ascertain the causes of cost overruns by considering both their frequency and the extent of their impact, in order to determine their overall influence on cost overruns. This aids in prioritizing the factors and, thus, determining the necessary mitigation measures to be implemented. This chapter will cover the study design and methods used to attain the previously defined research goal. The text presents data and information sources, research instruments, sample size, and technique of analysis.

RESEARCH APPROACH AND DESIGN

The research methodology began by identifying the topic through an unstructured literature review, archival study, and informal discussions with colleagues and specialists in the field. Subsequently, the research design was developed. Subsequently, the data and information sources were identified in accordance with the established research strategy. The research instruments were determined based on the data and information sources, and significant documentation sources pertaining to the research were examined. The evaluation encompasses a variety of sources, such as books, journals, internet sites, and other papers. Following a thorough examination of relevant literature and a comprehensive analysis, a questionnaire enumerating the different factors contributing to cost overruns was disseminated to reputable building contractors, clients, and consultants. The purpose was to gather their expert opinions based on practical experience. After acquiring the desired data, the process of verifying and organizing the data has been completed. The data were subsequently examined to verify the accuracy and consistency of the information gathered during the entire research process. Subsequently, extensive deliberations were conducted to

reach a definitive conclusion and provide recommendations based on the study's findings.

A research methodology employing an objective type survey design was utilized for this study. An effort was made to gather data from the appropriate demographic in order to prioritize the sources of cost overrun based on their significance. This survey-based study design has been chosen due to its efficacy in illustrating the pervasiveness of the issue across the entire population. Once the distribution of the problem has been assessed and major causes have been recognized, it may be feasible to obtain insights on how to mitigate the situation. Additionally, it aids in discerning disparities across various groups and suggesting potential solutions to be implemented by the relevant parties involved.

SOURCES OF DATA

The research employed a questionnaire survey as the instrument to identify and prioritize the sources of cost overrun. The questionnaire was utilized to obtain expert opinions and other pertinent data. In addition, a literature research was done to establish the conceptual foundation for the study.

The literature review identified potential factors that contribute to cost overrun, examined the consequences of cost overrun, and explored strategies for controlling and managing costs. The review served as the foundation for developing the questionnaire, which was subsequently circulated to professionals engaged in the construction industry.

Stratified sampling procedure was applied to separate the experts and management of client, consultants and contractors in the project team. From those strata of experts and management, the sampling frame of the study was selected by using simple random sampling. This means, each member of the strata has an equal chance of being included in a sample by using probability proportions that have worked directly in the project construction. Stratified sampling was selected because there were different characteristics among teams of client, contractors and consultant. However, there were similarities between each team member in the strata.

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