PROJECT MANAGEMENT FOR ENGINEERING AND CONSTRUCTION

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CHAPTER 1

DESIGN COORDINATION: EFFECT PROJECT MANAGEMENT STRATEGIES

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ABSTRACT:

The design team leader must create a work plan in order to efficiently organize the design process. When preparing the design proposal, the design work plan should be created. Any work plan must contain the scope, budget, and timeframe for completing the task. The work that has to be done by the different design disciplines is integrated and interfaced based on the design work plan. The plan also serves as the foundation for tracking the design effort's scope, costs, and timeframes. The design deliverables the drawings and specificationsfor each discipline involved in the design endeavor are specified in the scope of work for design. In most cases, the design cost is expressed in labor hours rather than monetary terms. The design work packages are often scheduled using a milestone bar chart. However, a CPM timeline is advised for significant projects.

KEYWORDS:

Construction, Coordination, Design, Projects, Scope.

INTRODUCTION

In engineering and construction projects, design coordination is a critical component of project management. It entails the methodical management and integration of design processes to guarantee that all project elements are in line with the project's goals, needs, and specifications. The importance of design collaboration and its contribution to project success are briefly discussed in this introduction.To obtain a cogent and well-integrated design, design coordination is crucial in engineering and construction projects. To make ensuring that all design components function in unison with one another, it entails coordinating the activities of architects, engineers, contractors, and other parties engaged in the design process.Design coordination is to avoid confrontations, disagreements, and mistakes in design that might result in expensive rework and delays during the building process. Project managers may detect and address any conflicts or concerns early on by coordinating design tasks, which reduces schedule interruptions and saves time and money[1]–[4].

Coordination of the design also makes ensuring that it adheres to the project's criteria and objectives. It entails checking the design against the project requirements, building codes, rules, and industry standards. This aids in upholding compliance, reducing hazards, and guaranteeing the project's use, safety, and quality.Collaboration and communication are key components of design coordination. It encourages efficient communication between all parties involved in the project, including the architects, engineers, builders, and subcontractors. Design coordination improves cooperation, stimulates creativity, and aids in attaining design excellence by facilitating collaboration and information exchange. Coordination of the design process is also essential for cost control. Early detection of design conflicts or inefficiencies allows project managers to optimize design solutions, save costs,

and guarantee resource utilization. As a result, there are fewer design modifications made during the building stage, which lowers the risk of cost overruns and project delays.

For engineering and construction projects, design coordination is a crucial step in the project management process. It guarantees that design aspects are integrated, compatible, and compliant, reduces disputes and mistakes, and increases project effectiveness. Project managers may reduce risks, enhance project results, and raise the possibility of project success by efficiently managing design processes. The process of design coordination is dynamic and requires ongoing monitoring, assessment, and adjusting as the project develops. To handle design-related issues and guarantee efficient project execution, project stakeholders must effectively communicate, collaborate, and make decisions.The right tools, technology, and processes must be used to enable efficient teamwork and communication in order for design coordination to be successful[5]–[7].

These might include collaborative project management tools, virtual design and construction (VDC) platforms, and building information modelling (BIM) software. Additionally, design coordination spans the whole project lifespan, not just the pre-construction stage. To guarantee that design adjustments, alterations, and updates are properly communicated and executed, it entails continual coordination between design teams, construction teams, and other stakeholders.In the end, effective design coordination is necessary to produce a project that is coordinated, practical, and aesthetically beautiful. It helps to reduce risks, improve project quality, and provide work that meets or exceeds customer expectations. Project managers may create a solid basis for a project's success and encourage seamless cooperation among all stakeholders engaged in the design process by highlighting the significance of design coordination[8], [9][10].

DISCUSSION

The scope of work for design establishes the deliverables for each discipline involved in the design endeavor, including the drawings and specifications. Work hours rather than money are often used to calculate the design cost. Normally, the design work packages are scheduled using a milestone bar chart. A CPM timetable is suggested for big projects, nevertheless. The design team leader creates a work breakdown structure after going through all the backup material to identify the different task packages necessary to produce the design deliverables, the drawings, and the specifications. Then, for each work package for each discipline, such as architectural, civil, structural, electrical, and mechanical, a certain number of design hours is allocated. Next, a milestone bar chart for the design work packages is created. Assigned labor hours to each job in the milestone bar chart indicates that the bar chart is cost loaded. For monitoring and organizing the project throughout design, output from the cost-loaded bar chart is often supplied on a weekly basis. Then, for each week throughout the design phase, a simple earned-value analysis similar may be carried out. The earned value of each work may be calculated by dividing the percent complete by the planned design hours. To assess how well the design process is working, the gained value may be compared to the actual design hours charged to the task and the expected design hours.

Producing Contract Documents

It is now possible to evaluate a wide range of design possibilities that were previously unfeasible using manual techniques thanks to the development of computers for designing and creating contract papers. However, overusing computers may result in excessive overdesigning, overwriting, and over drafting. Examples include process engineers, hydraulics engineers, and structural engineers who wish to conduct one more computer simulation or load check. The specification writer may continue to cut and paste a new

section into the contract paperwork, or the CADD operator may wish to see how a design would appear if another modification is made. Occasionally, excessive simulating, designing, or writing might result in mistakes in the contract papers. The lead designers must create a system for keeping track of the design effort to make sure it is moving forward without racking up too many billable hours while yet delivering sufficiently detailed drawings and specifications for the contractors to follow throughout construction. This will lessen complaints from building contractors about attractive designs that are flawed and impossible to build.

Managing Scope Growth during Design

Some designers have a propensity to make adjustments throughout the design process in order to appease the customer, regardless of the effect on the project's budget and timeline. Changes may be categorized as project development or scope expansion. Project development deals with adjustments required to fit the scope as it is now specified. Changes that expand the project's initial scopethe scope that was accepted before the design process beganare referred to as scope growth. Any design endeavor must have a procedure in place to manage scope expansion. Scope and change control must be a priority for both the owner and the engineer. After the conceptual design phase, the project owner must be committed to freezing the project's scope. Every proposed modification must go through a thorough assessment and approval procedure that takes into account the potential cost and schedule impacts as well as any knock-on consequences on other operations. The power to approve modifications made during design must be restricted.

A change management philosophy and strategy should be agreed upon by the engineer and owner. For instance, under what circumstances would modifications be taken into account: If it won't function? Does this have any legal repercussions? Whether any environmental effects exist? Questions like Does the change add value? and is the change necessary? must be addressed when modifications are presented.

The owner and the engineer should come to an agreement on a no-later-than date for freezing scope. Although the recommended practice for effective project management is to freeze project scope after the conceptual design stage, it should be acknowledged that on certain projects the owner must compete in a highly competitive market to develop a product. In a market with intense competition, the owner may want the freedom to make changes. The project scope both throughout design and construction to ensure that it will function as intended after finished.

The design team's task is more complicated in this kind of circumstance, and more care must be taken to inform the owner of the entire effects of scope adjustments. The price of engineering and building for the scope adjustment must be weighed against the owner's potential financial rewards in the form of revenues, operations, and facility upkeep.A management reserve for scope expansion and a contingency for scope modifications should both be included in the project budget. Any proposed change must be communicated to all discipline supervisors and anybody else whose job might be impacted. Then, if the modification is adopted, these managers should ascertain and report the cost and schedule implications.

The owner's representative, the engineering manager, and the project manager must all examine and accept the aforementioned implications before work can start on the modification. After a change has been accepted, it's critical to let individuals who may be impacted know why the change was made.

Managing Small Projects

It is typical for a project manager of small projects to oversee many projects at once. The management of any one project is not the issue. The inability of the project manager to give each project the necessary attention makes scheduling and resource management more difficult. Because there aren't much personnel available for small projects, the project manager must pool resources with other project managers. The few people who have been allocated to the project must thus assume responsibility for a variety of tasks. Planning ahead is essential. The project manager often finds themselves waiting for information or juggling the urgent demands of numerous projects at once. Small projects often have a very short lifespan, which leaves little time for thorough planning or problem-solving while the job is being done. By the time the project is over, workers are often still on their learning curve. The project manager must create a single master schedule including all the projects under his or her control in order to handle several little tasks. This will help to lessen circumstances when two or more support staff are required simultaneously. Instead of arranging the work on only one project, the issue is scheduling the project manager's many duties. Small projects are managed by more managers than big ones. Numerous engineering firms establish organizational divisions specifically for the project management of minor projects. Upper management must pay particular attention to and focus on the issues posed by managing small projects. The characteristics of project team members that excel at managing small project.

Attributes of Small Projects Team Personnel

1. Have a can-do attitude.
2. Prefer a hands-on approach to work.
3. Dislike bureaucracy.
4. Are decision makers.
5. Need little or no supervision.
6. Have a value system to make the customer satisfied.
7. Are good communicators
8. Prefer to talk out problems
9. Know when to stop an activity when things are going wrong
10. Has the personality and people skills to coerce people to be responsive to his or her needs
11. Has the ability to navigate through the various departments of his or her company to get things done

Project Team Meeting

Design is a creative process that includes a range of specialties and countless choices that have a significant influence on a project. Each designer's work often has an impact on the work of one or more other designers.

The integration of related tasks to guarantee project compatibility is a challenging challenge in design coordination. In most cases, the challenge is integrating the work of all designers rather than finding design experts who know how to execute the job. Effective communication during regularly scheduled team meetings is the only way to achieve this. Weekly team meetings are necessary for the length of a project. These sessions are required to maintain the team's cohesiveness and to guarantee a constant flow of information. Conflicts abound in a regular project. The participation of all people who are impacted is the greatest method to swiftly settle these disputes. Only open dialogue and compromise will

allow for this. The project manager is in charge of all team meetings, but they shouldn't be dominated by him or her. Often, a team member may be tasked with facilitating talks to address issues pertaining to his or her specific field of expertise.

Project managers must use their own discretion and have the talent of recognizing when to take the initiative and when to delegate that responsibility to others. To guarantee that important topics are covered and the meeting is over as quickly as possible, an agenda should be created to guide project team meetings. The agenda should contain a list of the topics to be covered, including work that has been finished, work that is still being done, work that is planned, and unique issues. Team meetings should include all participants.

The project manager should write up and distribute meeting minutes to all attendees. The project manager is responsible for making sure meetings are fruitful. Meetings are necessary and necessary, but if they are not well organized and executed, they may cause annoyance and waste time. There are instructions for running team meetings

Guidelines for Productive Meetings

1. Develop and publish an agenda in advance to permit better participation by attendees.
2. List unfinished items from previous meetings on the agenda, including the names of individuals who are responsible for reporting on status.
3. Restrict attendance only to individuals who need to attend.
4. Don't waste time by discussing events that do not pertain to the purpose of the meeting.
5. Pick a meeting leader who is a leader and facilitator, not a dictator, to ensure the meeting is conducted in an informative environment.
6. Maintain strict agenda control; follow the items in order with set time limits for discussions.
7. Avoid interruptions, such as phone calls, as much as possible.

Weekly Monthly Reports

The process of creating reports is ongoing in project management. Reports must be delivered often and include information that is useful to the recipient in order to be meaningful. The propensity to include everything in a report leads to documents that are so large that crucial information may be missed. Generally speaking, the project manager should create two regular reports for each project, a weekly highlight report and a monthly report.

The minutes of the weekly team meetings include a lot of information that is used in the weekly highlight report. Work accomplished, work in progress, work planned, and unique issues should all be included in the report. The project manager and his or her team often utilise the weekly report to organise the ongoing work. Project milestones that have been reached, a comparison of actual costs to anticipated expenses, and an overlay of the planned and actual time schedules should all be included in the monthly report.

The estimated project completion date and a projection of the final cost should be included in trend reports as well. Upper management and the owner's representative often utilise the monthly report, which serves as a permanent record for the project file. The weekly and monthly reports should both have a uniform structure so that comparisons of the project status, the progress of the work, and the team's performance can be assessed. The reports serve as a measure of individual responsibility and appreciation of excellent performance in addition to providing project progress updates.

Constructability

Engineering and construction are often divided early on in the project. The use of cutting-edge technology, including three-dimensional computer-aided drawingConstruction automation, robots, and computer-aided design (CADD) have all raised awareness of a project's constructability. These new developments make it possible to modify designs to facilitate effective building, which emphasises the need to combine engineering and construction to include constructability's input into the design process (Figure. 1). The objective is to make it easier for construction and design to communicate ideas before, during, and after design. The CII has produced studies and financed research on constructability. A solid explanation of constructability concepts for conceptual planning, design and procurement, and field operations may be found in CII Publication No. 3-3, titled Constructability Concepts File. The passages from the following paragraphs are the report's contents by providing examples.

Simplicity, flexibility, sequencing, substitution, and labour skill/availability are at least five elements that should be taken into account while deciding on design configurations for efficient construction. Any constructible design should have simplicity as a desired feature. Unjustifiedcarnality serves no one's best interests and significantly raises the likelihood of a poorly finished project. Particularly for refit or rebuild projects, special drawings and instructions may be needed to increase the constructability procedures. It would be ideal if construction workers on the ground had the freedom to choose different techniques or fresh ideas.

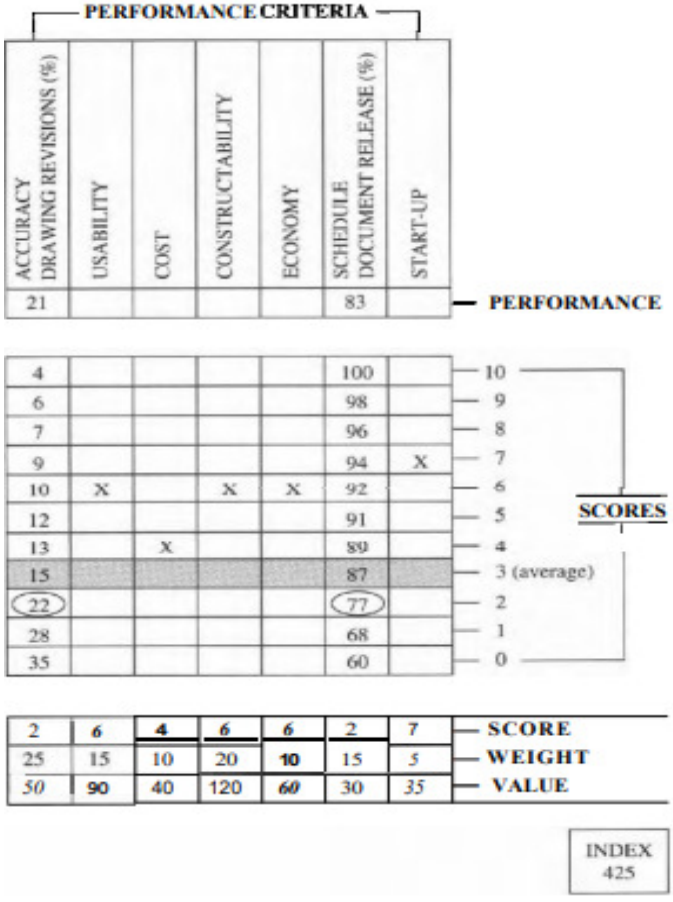

Figure 1: Represting the Design Matrix Using Quantitative Evaluation[AccessEngineeringLibrary].

Designs should outline the intended outcomes without placing restrictions on how they will be attained. It is also desired to provide designs that do not restrict the building techniques or approaches in the completely open and competitive market. Installation sequencing is a design issue as much as it is a procurement and construction one. Designs have been developed that unnecessarily limit how installations are performed during construction. Layout and facility spacing should be carefully considered during design to allow for many construction operations to take place simultaneously. Although substitutions and alternatives merit consideration, they are often disregarded due to the pervasive belief that a certain method has always been used. Constructability will be impacted by improperly considered material applications, necessitating expensive adjustments. When constructability programmes are used throughout the design process, these effects may be reduced and even avoided. The availability of labour is often not taken into account early enough in the life cycle of a project. It is important to investigate both the skill level of the employees and the labour availability. Lack of either skill levels or labour availability may have an expensive effect on a project and must be taken into account during the design process. According to CII research, project or firm size is not a hindrance to constructability or the execution of a constructability programme. Improved projects, cheaper costs, improved productivity, and faster project completion are all benefits of include construction in the design process. The idea that construction simply reviews designs to choose the one that is simplest to build is a significant barrier to the adoption of successful constructability programmes.The constructabilityprogramme implementation recommendations are provided in CII Publication No. 3-2.

Post Design Review

Project management must be improved, and evaluation is a constant process. The project manager's organization's work management system must be adaptable enough to take into account the variances in each project. The project manager must decide at the start of each project what system changes and enhancements are necessary and suitable for the project. Each project's design is finished, and the project manager and his or her team needs to perform an in-depth assessment of the management of the design process as well as the design effort. Each member of the project team and any significant participants who were engaged in this assessment should be design. To evaluate every aspect of the project, including scope expansion, quality and scope alignment, owner expectations and satisfaction, conflicts among team members or with other parties, excessive schedule changes, comparison of final costs to the original budget, and a list of precautions for managing future projects, a check list should be created. The project manager should put out a quick summary report after a comprehensive discussion of the design process that includes suggestions for how to make the system better for next projects.

CONCLUSION

Project management for engineering and construction projects requires careful consideration of design coordination. It makes ensuring that design components are integrated, compatible, and compliant, reducing disputes, mistakes, and delays during project execution. Proactive communication, cooperation, and decision-making among project stakeholders are necessary for effective design coordination. Project managers may save time, money, and avoid scheduling problems by coordinating design efforts to detect and address possible issues early on. It aids in preserving conformity with project requirements, building codes, rules, and industry standards, assuring the project's operation, safety, and quality. Through the optimization of design solutions and a decreased possibility of expensive design revisions during the construction phase, design coordination also plays a vital role in cost control. It

fosters creativity and achieves design excellence by facilitating good communication, collaboration, and information exchange among team members. Utilizing the right tools, technology, and processes to promote collaboration and communication is essential for effective design coordination. It is a continuous process that involves coordination between design teams, construction teams, and other stakeholders. It lasts the duration of the full project lifetime. Effective design coordination is necessary to provide a project that is coordinated, practical, and aesthetically beautiful. It helps to reduce risks, improve project quality, and provide work that meets or exceeds customer expectations. Project managers may successfully handle design-related difficulties and guarantee the success of engineering and construction projects by giving design coordination top priority.

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CHAPTER 2

A BRIEF INTRODUCTION ABOUT CONSTRUCTION PHASE

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ABSTRACT:

Because of how closely the quality of the finished product depends on the craftsmanship and management of building, the construction phase is crucial. The completeness and quality of the contract documents that the designer prepares, as well as three additional factors laborers with the necessary skills to produce the work, field supervisors with the ability to coordinate the numerous activities needed to complete the project on the ground, and the quality of the materials used in project construction have an impact on how well the project is built. To complete a project of high quality, professional laborers are needed as well as efficient administration of the trained laborers.

KEYWORDS:

Bid, Contract, Construction, Designs, Owner.

INTRODUCTION

The fact that the building phase consumes the bulk of the project's money and schedule makes it crucial. As mentioned in earlier chapters, a project's design expenses typically fall between 7% and 12%. 90% of a project's cost, assuming a median value of 10%, is spent on construction. Therefore, a 15% variance in design costs may only have a 1.5% effect on the project, but a 15% variation in construction costs may have a 13.5% impact. Similar to prices, a project's construction time is always disproportionately longer than its design time. Most owners need to utilize their projects as soon as possible, thus any delay from the anticipated completion date might result in serious problems for both the owner and the contractor. The construction contractor must carefully plan, organize, and manage the project in the most effective way possible due to the dangers that are inherent in building and the many activities that must be completed[1]–[4].

Assumptions for Construction Phase

The goal of the construction phase is to complete the project on time, within budget, and in compliance with the plans and specifications. There are three presumptions necessary to accomplish this goal, as stated. Due to the nature of building work, there are sometimes variances even when the assumptions are plausible. A project is a unique, one-time business venture. Each project is different; thus, its conclusion can never be anticipated with complete certainty. In order to build a project, the owner often contracts with a contractor that supplies all labor, tools, materials, and construction services in accordance with the designs and requirements. This necessitates managing a variety of activities and duties at once, while also interpreting blueprints and coping with inclement weather. Some people find it challenging to admit that plans and specifications do include flaws. A lot of people are needed to prepare a design because they must organize supporting tasks, execute design calculations, and create several sheets of elevations, sections, details, and dimension drawings. Although perfection in

a set of designs and specifications is something that every designer aspires to, it is seldom attained. Before beginning construction, the owner typically accepts and approves the contract paperwork. However, the owner's desires aren't always reflected in the designs and specifications. Members of a board of trustees, board of directors, or commission may represent the interests of certain owners, notably non-profit Organisations or government bodies. These people often come from backgrounds in professional or corporate jobs, with little to no experience in project work or drawing interpretation. Since they won't see the final product until it is placed during construction, they may endorse the choice of a material or project arrangement. If the contractor submits a bid price that is less than what is necessary to construct the project and make an acceptable profit, serious issues might result for both the owner and the contractor[5]–[8]. A contractor that underbids a project may potentially pose serious issues for the design firm. A construction firm is a business that has to generate a profit in order to stay in business. Before awarding a construction contract, each contractor's proposal must be carefully considered. If a construction contractor underbids a project, project management will be challenging no matter how competent the people involved are.

Assumptions for Construction Phase

1. **Scope:** The design plans and specifications contain no errors and meet the owner's requirements and appropriate codes and standards.
2. **Budget:** The budget is acceptable that is, it is what the owner can afford and what the contractor can build it for, with a reasonable profit.
3. **Schedule**: The schedule is reasonable; that is, short enough to finish when the owner needs it and long enough for the contractor to do the work

Circumstances like owner-requested adjustments during construction, changes to the design, or different site circumstances might occur and affect the project price and timeline. There should be a suitable contingency to account for these sorts of deviations that might negatively influence the project budget and schedule in order to lessen the effect of these circumstances. Contractors must be given enough time to complete their tasks.

The quality of the project and worker productivity will suffer if a reasonable amount of time is not given. During construction, there are many variables that might prevent work from moving forward as planned, including the weather, material deliveries, answers to concerns about the design, and inspection. The contractor is required to provide a schedule that accounts for the acceptable fluctuation in time that is inherent in the building process, as well as to plan ahead for all project needs. The aforementioned issues must be dealt with by the project manager. He or she must continuously make plans and be on the lookout for these circumstances. To respond to new circumstances, the project will need to be adjusted and coordinated[9], [10].

DISCUSSION

The method used to pay the construction contractor may have a significant influence on the project's budget, timeline, and amount of owner and designer engagement. Fixed price and cost reimbursable are the two broad categories into which contract pricing may be separated. For fixed-price agreements, the contractor may get payment in the form of a flat amount or a per-unit charge. Cost-reimbursable contracts may contain payment mechanisms by all of the following, individually or in combination: cost plus a predetermined percentage of the total cost, guaranteed maximum price, or incentive. The benefits, drawbacks, and circumstances that favour the usage of the aforementioned payment methods for building services have all been covered in a number of publications and articles. A summary of what has previously been written is provided in the following paragraphs to help the project manager in their

managerial duties. By delivering a full set of plans and specifications that have been developed by the designer prior to construction, lump-sum contracts aim to fix the project's cost. For any alterations that could be required during construction, the contractor is nonetheless entitled to additional remuneration.

Changes made during construction are a significant cause of cost overruns for lump-sum contracts. For these kinds of initiatives, it's crucial to guarantee a thorough design that's as error-free as feasible and to limit any owner alterations. Before inviting bids, the contract documentation must be sufficiently reviewed to find any inconsistencies and ensure that the project can be built. Because a change in one area of the project often impacts other parts of the project, the project manager should collaborate with the owner throughout construction to assess the complete impact of a project modification, including the influence on the project's cost and schedule. Before the construction contract is finalised, a pricing schedule for labour and equipment for additional work linked to project amendments should be established. Unit-price contracts are chosen since it's possible that the amount of work can't be estimated precisely enough for a contractor to submit a lump-sum quote. Errors in the expected compensation are a significant cause of cost overruns for unit-price contracts.

Quantities. Unbalanced bids from contractors might result in considerable increases in the anticipated cost of the project and costly legal issues if errors in projected pay amounts are present. All predicted remuneration should be carefully reviewed. Prior to the invitation for contractor bids, the number of unit-price contracts. After receiving all of the bids, each unit-cost bid item should be carefully examined to look for any bid unbalancing. Reviewing big quantity pay items and any abnormally large unit-cost bid items in particular may help find any inconsistencies. For some projects, it is preferable to begin construction before the design is finished. These projects might be complex or urgently needed to be completed, in which case it would not be feasible to produce a complete detailed design of the entire project before beginning construction. Cost-reimbursable projects need intensive material delivery tracking and labour assessment. To assess and approve the project's material, labour, equipment, and other charges, the owner's organisation must set up a field office. For owner organisations that need the freedom to alter the project as necessary during construction to obtain the best results and fulfil their goals, this style of contracting may be effective. However, the proprietor must have a lot of project management expertise.

Build Method of Project Delivery

Design-bid-build (DIBIB) is sometimes referred to as the conventional project delivery approach. Before commencing the bid and construction phase, all design work is finished. When cost is the project's top priority, timeline is its second consideration, and the scope is well specified, this delivery approach is often chosen. The owner, designer, and contractor are all involved in the DBB project delivery technique. A contract for design services is signed by the owner with the designer, while a separate contract for construction services is signed with the contractor. The owner employs both the designer and the contractor. Although the owner often appoints the designer as their representative throughout construction, the designer does not employ the contractor. The designee is often compensated on the basis of a pre-set fee or a portion of the construction contract.

The contractor receives payment in the form of a lump sum: The owner gets the chance to see how the project will appear before moving forward with construction, which is when the highest expenditures will be expended, since design is finished before bidding. The contractor can accurately predict the cost of construction since they have a thorough grasp of the project's needs. As a result, the owner is able to estimate project costs prior to signing

construction contracts. All parties' responsibilities, risks, and engagement in DIBB are clearly stated. Due to the fact that the contract agreements clearly outline what the contractor must perform, the owner has a reasonably high degree of engagement and control throughout the design phase but less involvement during the building phase. The D/B/B project delivery method's major drawback is the extra time that may be needed to finish the design and put the project out for bid. Real construction to begin. The owner may incur costs as a result of changes made after construction contracts have been awarded.

Build Method of Project Delivery

The design build (Dm) project delivery approach is often used to speed up project completion. Construction may begin before all the design work is finished, which often reduces the completion time. The owner has a high degree of engagement and control over the whole project. This gives the owner freedom to change the design while work is being done. The D/B project delivery technique is often used for projects when the time, cost, and scope are all important factors. The owner and the DIB business are both parties to the D/B method of project delivery. The owner and the D/B company enter into a contract for the performance of both design and construction services. The DB contractor is responsible for all design work, including the construction drawings. Although the D/B contractor may use one or more subcontractors, they do all of the work themselves.

The DB business often employs both skilled construction workers and in-house designers. Conflicts between the designer and contractor, which often arise in the D/BB delivery process, may be lessened by this arrangement. To perform D/B work for the owner, a construction contractor may sometimes link up with a design firm or a design firm would team up with a design business. Qualifications-based selection (QBS) is a standard method for selecting the D/B Company. The business owner requests offer from companies on a preselected or prequalified list. Each potential D/B business is put through an assessment procedure to evaluate their quality, safety history, schedule, cost performance on previous works, and other aspects. Selection is thus based more on qualification than on cost.

Typically, the price of the D/B services is determined by some kind of cost-reimbursable agreement, such as cost plus a predetermined sum or cost plus a percentage. The D/B Company may be chosen for projects with a well-defined scope depending on pricing. The contract for incentives may be based on a predetermined maximum sum, with bonuses for costs that are less than the promised sum and penalties for costs that are more than the stipulated sum. Despite being a crucial factor, the entire project cost is not clearly known at the start of a D/B project since the design has not yet been produced. Because the designer is also the builder, handling inspection is a problem that has to be addressed early in the project. The owner may conduct inspection if competent persons are present inside the owner's organisation. In certain circumstances, inspection services are provided by a neutral third party.

Prospective Bidders and Bidding

The choice of the contractor is crucial because the contractor is crucial to the project's successful completion. In order to construct the project in accordance with the plans and requirements, the owner and designer must rely on the contractor to provide the necessary labour, tools, materials, and expertise. Everyone has issues if the contractor does. Before a bid is approved, the owner often needs potential contractors to provide a bid bond. Most owners demand that the contractor produce a performance bond in addition to a material and labour payment bond before a contract is awarded. Before beginning fieldwork, the contractor provides the owner with copies of all bonds. Bonds do provide the owner some

degree of security, but they cannot ensure that the work will go well. A prequalification procedure that assesses a potential bidder's record of experience, financial competence, safety record, as well as overall character and reputation in the sector, should be used in addition to bond requirements. In order to give a representative cost comparison for projects with a competitive bid process, at least three bids should be obtained. A bigger number of bidders will often result in more competition and cheaper bids. The quality of the bidders, however, matters more than the sheer number of bids. It is feasible to regulate which businesses are permitted to make a bid for private projects. It is preferable in this sort of circumstance to not let firms to submit bids if their qualifications are in doubt or if they are the project was just not desired to be built.

The amount of time permitted should be carefully taken into account. Contractors to provide prices. The recommended deadline date must provide enough time for bidders to complete a complete bid. A respected contractor may be approached to help establish a reasonable time for bid preparation if it is unclear what period of time would be suitable. Some bidders may decline if the time limit is too short, or worse, the offer may not be well prepared. Construction is hampered unnecessarily if the bid period is too protracted. An addendum is a modification made to the bid package during the bidding process to fix mistakes, clarify project specifications, or make adjustments before the contractor is given the go-ahead. Numerous addenda might drive off respectable bidders or put them in a risky beware position about the quality of the designs and specifications or the likelihood of future revisions the owner could make during construction. These circumstances may result in pricey change orders that have a negative impact on the project's overall cost.

To define any unique elements of a project and aid bidders in creating a strong proposal, a prebid meeting should be organised. This is a good moment to define the project's scope, describe any unique working circumstances, and respond to contractor inquiries. All parties shall get written confirmation of any item that was discussed during the meeting but was not included in the bid papers. Using the same set of bid papers that the contractors are using to submit bids, the party who will manage the contract should provide a thorough cost estimate for every project. This will help with the assessment of contractor bids since creating an estimate requires a thorough examination of every facet of the project. By carefully reading the bid papers and going through the process of creating a precise cost estimate, many project-related issues may be found. If the organisation of the party that will handle the contract has the necessary expertise, there are several professional estimating firms that may do this job.

Qualification-Based Selection (QBS)

Construction contractors are often chosen based on the lowest and best-qualified bidder for lump-sum, fixed-price projects. Since each contractor is obliged to submit a bid price, finding the lowest price is rather straightforward. The contractors are often asked to submit a prequalification form prior to bidding in order to guarantee qualification. Typically, the form asks for details on the contractor's standing, stability, and ability to complete the job. Most bid papers also call for a bid bond to be presented with the bid when it is delivered to the owner. When a contractor is eligible for bid bonds, the owner is often assured that they will also be eligible for payment and performance bonds after the contract is signed. Contractors are often hired based on QBS for cost-reimbursable projects or negotiated contracts as the project's cost isn't known at the time the contractor is picked. Usually, the owner compiles a short list of potential contractors, each of whom would probably be chosen for the job. Gatherings are conducted to offer each the chance for the potential contractor to inquire about the details of the proposed contract and the owner's ideal project conclusion and obtain

explanations. The gatherings are educational in character and may include a trip to the project location. After then, contractors are requested to submit official requests for bids (RFPs).

The was typically asks for details on the technical and managerial capabilities of the project as a whole, the method to be adopted in conducting the project, as well as a cost estimate. To enable the owner to assess offers uniformly, each contractor receives an RFP with a predetermined format. The owner evaluates all ms after receiving them. The merits of each cost suggestion are evaluated. The owner must assess the viability of each contractor's cost estimate since the true cost is unknown. A fee schedule for all labour, supplies, and indirect costs that would be associated with the project may be included in the cost proposal. The owner often seeks a competitive pricing range rather than the lowest price. Costs are taken into account, but the best and last offer is chosen in the end. A weighted assessment technique is utilised to provide a quantitative evaluation of each RFP in order to choose the best and final bid. For instance, the RFP is broken down into categories, and each area is assigned a weight according on how important it is. While some categories could have equal weighting, others might receive differing weights. An example of assessment categories is shown below.

1. Management information system.
2. Project schedule.
3. Personnel Contractor quality control.
4. Management of subcontractors.
5. Resource utilization.
6. Health and safety approach.
7. Financial capacity.
8. Experience and references.

Software for CADD, scheduling, cost estimation, accounting, submittal reporting systems, and other pertinent data may be included in the management information system. The degree to which a company has developed an efficient management information system is an indicator of its capacity to keep a project's budget steady throughout both the design and construction phases. A suitable project timeline, either a bar chart or a network, should be presented. It should highlight the key milestones needed to finish the project. Since cost is a factor in choosing contractors, a cost estimate ought to be necessary.

The cost estimate does provide a general idea of the ultimate cost even if it is unknown at the moment a contractor is selected. The quality of the workforce is crucial when QBS selects contractors. Resumes of key individuals should show a team that is capable of completing the project's job requirements. Key team members' formal education, project experience, and professional registration are all signs of their competence.

A list of the persons, materials, and significant subcontractors to be used for the project should be included in each bid. Multiple subcontractors must be managed for engineering and construction projects. A strategy for procuring supplies, tools, services, and subcontractors should be included in the RFPs that QBS requests from potential contractors. The proprietor must Prior to receiving RFPs from potential contractors, the company must give a list of its preferred providers. Any QBS process should also include information on resource utilisation, including a thorough explanation of the staffing strategy to manage the project's naturally varying workload and guarantee the presence of an experienced workforce throughout times of work build up and drop. For the purpose of selecting contractors via the QBS method, a quality assurance and quality control (QA/QC) programme should be completely documented in the RFP. The system should include quality control throughout the construction process, including testing, inspection, and safety, as well as during the creation

of design drawings and specifications. Each project should have its own specific set of evaluation criteria for contractor offers for QBS. Final decisions are often made based on a combination of time, budget, technical merits, and quality.

Technical excellence, managerial skill, staff credentials, previous experience, past performance, and timetable compliance are all examples of how quality may be conveyed. Although choosing a contractor based on pricing is fair, the ultimate decision may be made based on the proposal that provides the owner with the most in terms of performance value. The cost proposal shouldn't be the deciding factor for cost-reimbursable contracts since preliminary cost estimates could not be a reliable predictor of final real costs. The lowest proposed cost or lowest total proposed cost plus a charge is often not used to determine which contract would be cost-reimbursable. The chance of cost overruns may rise if cost-reimbursable contracts are awarded solely on the basis of predicted costs, since this may promote the submission of overly low estimates. The business with the plan to carry out the contract in a way that benefits the owner the most should be the main factor, as decided by assessment of proposals in accordance with defined evaluation criteria. The owner assigns numerical weights to each factor that is taken into account. The weights' value is often kept a secret from the businesses making bids. The RFP, however, may provide potential contractors with information on the minimal standards that apply to certain assessment criteria or sub factors. Based on the weight of each aspect, the owner gives each one a score throughout the evaluation process. Whichever RFP earns the highest rating will be used to choose the contractor. After that, the contractor is informed, and a contract in advance is created. A contract is signed after everything is finalised.

CONCLUSION

For engineering and building projects, the construction phase is a crucial step in the project management process. It entails putting the project strategy into practice and turning design ideas into tangible buildings. The major points addressing the importance and results of the building phase are outlined. Project managers supervise the execution of construction tasks throughout the construction phase to guarantee that they are completed in accordance with plans, timelines, and quality standards. To efficiently and successfully perform construction activities, it entails managing a variety of resources, including labor, supplies, equipment, and subcontractors. The efficient management and monitoring of the project is essential to the successful conclusion of the building phase. Project managers need to keep a careful eye on the work being done, monitor expenses, and deal with any problems that may come up. The necessary requirements and specifications are met by routine inspections and quality control procedures. Strong communication and cooperation amongst project stakeholders are also essential throughout the building phase. The construction team, subcontractors, and other stakeholders participating in the project must be adequately informed about the project's objectives, plans, and expectations. Collaboration encourages teamwork, encourages problem-solving, and boosts productivity. Additionally, throughout the building phase, safety monitoring is crucial. To safeguard employees, reduce hazards, and guarantee adherence to safety standards, project managers must adopt and enforce the necessary safety procedures. The success of the project as a whole and the welfare of the construction crew depend on maintaining a safe working environment.The project's physical realization results from the building phase's successful conclusion. It signifies the accomplishment of project deliverables, milestones, and goals. It prepares the groundwork for later stages including commissioning, testing, and project handover. For engineering and building projects, the construction phase is a crucial step in the project management process. It entails carrying out the project strategy, organizing resources, managing the project, and monitoring it.

Construction success depends on effective coordination, coordination, quality control, and safety management. Project managers can complete the project, fulfil customer expectations, and provide a high-quality completed product by efficiently managing the construction process.

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CHAPTER 3

PROJECT CONSTRUCTION: SIGNIFICANT IN PROJECT MANAGEMENT

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ABSTRACT:

Construction schedules specify the order of activities and their length, acting as road maps for project implementation. By outlining a precise timeframe for each activity and highlighting crucial dependencies, they assist project managers with resource allocation, procurement planning, and risk management. Project managers may maximize resource utilization, reduce delays, and guarantee on-time project completion by using effective construction scheduling. It aids in early conflict or bottleneck detection, enabling proactive mitigation measures and timetable modifications. Construction timetables also encourage cooperation and communication among project participants. All parties involved may use them as a shared point of reference, ensuring that everyone is aware of the project's timeframe, deadlines, and expectations. This encourages collaboration, cooperation, and wise decision-making. Construction schedules facilitate budget planning and control, which further aids in cost management. Project managers may track project expenses, monitor spending, and prevent cost overruns by matching project activities with the project's financial restrictions. Schedules make it possible to estimate costs accurately, assisting with resource allocation and helping to spot areas where money may be saved. The efficiency of building schedules has increased because to the usage of technologies such as scheduling software and Building Information Modelling (BIM). Project managers may use these technologies to develop dynamic timetables, integrate real-time data, and track project progress. They provide improved construction schedule management in terms of transparency, accuracy, and flexibility. The management of engineering and construction projects relies heavily on construction timelines. They provide a project execution road plan, maximize resource allocation, improve communication, and aid in cost control. Project managers may improve project efficiency, reduce delays, and guarantee successful project delivery by using construction schedules properly.

KEYWORDS:

Construction, Contractor, Equipment, Project, Work.

INTRODUCTION

The goal of scheduling a construction project is to make sure that the work is adequately planned so that it may be handled successfully and efficiently. A timetable must include all the tasks necessary to accomplish the activity, be arranged logically, and often be displayed as a time scale for simple comprehension. The goal is to make sure that all tasks required to finish the job are well planned and coordinated. As things change, the timetable has to be modified. The building contractor is responsible for both planning and carrying out the job. The timetable must be created with the job-site superintendent's involvement. The superintendent will participate in the daily management of theso that he or she has a better

understanding of how the task will be implemented. The timetable will be utilized to manage the work if the superintendent participated in its creation since he or she will have bought into it. Without the superintendent's input, schedules are seldom effective. Both the individual who prepared the estimate and the contractor's project manager are excellent sources of information and support for the site supervisor (Figure 1).

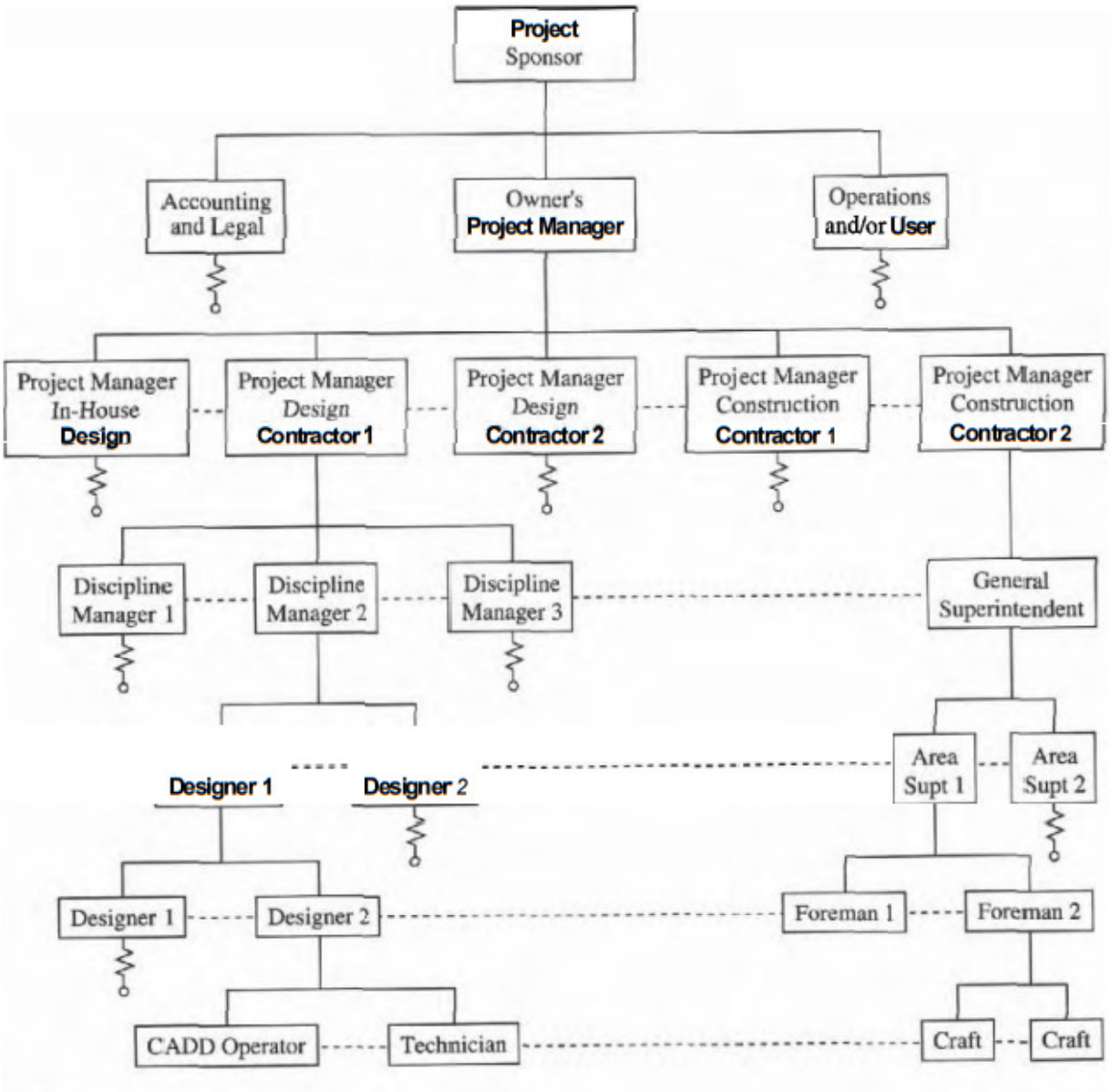

Figure 1: Effective Horizontal Communication Channels Necessary during Construction[AccessEngineeringLibrary].

Creating schedules is important, but the superintendent is the one who must organize the tasks in the order in which the project will be completed. The interests of the owner, the designer, and the contractors are all served by a successful building timetable. The construction timetable must, first and foremost, be readable and simple enough for the workers in the field to understand. Too often, superfluous details that are of little use to the field workers are included in the development of construction schedules. The schedule simply has to be detailed enough for the field supervisors to understand what is expected of them.

Area foremen in the field may then create a daily or weekly work plan for their specific tasks. For instance, if the schedule lists second floor painting as an activity, the paint crew's supervisor may create a daily work plan listing the precise rooms that must be painted during the week indicated in the construction calendar. Dates for the arrival of materials and equipment are crucial during construction since they often result in delays. To guarantee that supplies and equipment arrive at the project site when required, delivery dates for crucial activities must be continuously monitored[1]–[3].

DISCUSSION

In certain circumstances, a contractor could refuse to provide the owner with any timetable on the grounds that the owner won't be able to prove that the contractor didn't properly plan or coordinate the work in the absence of a schedule. An alternative argument contends that the lack of a timetable throughout construction enables the contractor to construct an as-planned rather than an actual schedule at the conclusion of the project to protect his interests in the event of disagreements or claims. Include the construction timetable as a particular pay item in the contract agreements as one way to encourage the contractor to create a suitable construction schedule. When the baseline schedule and each monthly schedule update have been submitted, the contractor would then be allowed to charge for this pay item. For instance, the mobilisation payment may be linked to the submission of the construction schedule. As a result, mobilisation expenses would not be reimbursed to the contractor until the construction schedule was provided. Due to the fact that the majority of contracts include payments to the contractor for mobilisation, this is simple to include in the construction contract. Unfortunately, there has been an increase in recent years in the use of construction schedules to support claims against the owner for extra time and expense. Some contractors will only create a timetable if the contract demands it. Construction contracts often relate costs to schedules, which has an influence on the contractor's monthly payment.

Some contractors create a plan with the idea that doing so would increase their chances of getting the owner to pay for extra time and/or money in change orders and claims. As a result, the schedule may sometimes be used to request more time or money rather than just as a planning tool to manage the project. Demanding, scrutinising, and accepting contractor timetables come with hazards. Schedules that have been approved or accepted may have legal repercussions for the owner. When an owner accepts a timetable, for instance, there is a chance that claims may be made against them using the schedule as evidence. Owner. The danger of not mandating building timetables is there, nevertheless. When there is no timeline, the contractor may not adequately design the project, and the owner has no means of monitoring cooperation or progress. The majority of seasoned construction managers agree that risks are reduced when building schedules are necessary. There are a variety of potential issues with construction scheduling, thus whomever is tasked with examining or approving construction schedules should proceed with care. The next paragraph lists a few of these safety measures.

Precautions for Construction Submittals

A submittal is a document that the contractor sends to the owner or designer for examination and approval. In order to avoid holding up the construction, the contract agreements may sometimes include that the engineer must assess contractor submittals in a reasonable amount of time. Typically, contractors include three or five days for submitting and review timeframes in the schedule. In the event that the timetable is approved, the duration indicated therein specifies what constitutes a reasonable period of time. Any review that takes longer is thus automatically deemed to be reasonable, creating a basis for delay or impact claims.

Other times, the timetable could not include any submitting dates at all. Instead, it is assumed that the submittals will begin the next day or on the same day as the construction activity. The contractor may then file a claim for delays every time a construction activity's commencement is postponed while the engineer analyses a submission for that activity. A clause stating the allocable time for submission review might be inserted into the contract terms to prevent issues related to submittal review timeframes.

For instance, a clause stating that the engineer must examine and reply to a contractor's Horntail within twenty calendar days of receiving a submission might be inserted. Additionally, the contract papers may provide that the contractor's resubmissions must be given the same amount of time for review as the original submission.

The debate over whether the owner and engineer should have a single time period in which to study the submittal and any resubmissionsor if the beginning time for submittal review should start afresh with each resubmissionhas been resolved totally as a result of this. This is a fair distribution of the risk of submitting unacceptable materials. Many issues with submission reviews and the effects of review delays may be avoided with a contract that includes submittal reviews in the construction schedule.

The contract may include a clause requiring the contractor to provide a construction schedule of all submittals needed for the project, including when each submittal will be made available for review. The contractor will be more likely to have a strategy for all submittals if this is done. Additionally, it enables the owner and engineer to properly plan their personnel and workload for the review procedure. It will be easier to include submittals if the designer provides a comprehensive list of all necessary submittals. In the timetable.

Delivery Dates of Owner-Furnished Equipment or Materials

In the construction sector, it is typical for owners to acquire and provide equipment or supplies with lengthy lead times. For the owner's benefit, this saves time and money.

The construction schedule normally includes the delivery dates for any equipment or supplies given by the owner. If the delivery dates for any materials or equipment provided by the owner are included on the schedule and the owner accepts the schedule, an implicit guarantee that the goods will be delivered by the date indicated on the schedule is created.

The contractor may submit a claim for additional expenses owing to work delay and impact claims if the owner is unable to fulfil the previously planned and agreed-upon delivery dates.

When the delivery dates for all owner-furnished products are indicated on the construction schedule relatively early, this might cause another issue. This gives the owner more chances to be held liable for delays if the owner-furnished goods are delivered later than expected.

The earliest delivery dates for all owner-furnished equipment might be included in the contract terms to assist prevent this kind of issue.

These dates may be based on the manufacturers stated delivery dates, plus a suitable time contingency. Making provisions in the contract terms that specify owner-furnished products will be supplied not sooner than one date and not later than another is another way to deal with the problem of claims relating to such things is one way to solve the issue.

The contractor is given some confidence that the products will arrive on the project site when expected in this way. Risk associated with owner-furnished products is decreased by giving a range of anticipated delivery dates.

Scheduling Contractor Procured and Installed Equipment

The construction schedule, which only lists equipment installation as one activity, does not adequately describe the labour required to acquire and install the equipment. The fabrication, delivery, and installation of large pieces of equipment purchased and installed by the construction contractor should be shown as independent operations. This guarantees that the contractor has made enough plans and eliminates uncertainty about the manufacturing and delivery schedules. The pay request from the contractor for the equipment is also made clearer since it is anticipated that the pay request for equipment purchase will come much sooner than the pay request for equipment installation. Which pieces of equipment are regarded as significant should be specified in the bid papers by the designer. Another way to aid in the correct planning and scheduling of contractor-provided equipment is to add a clause in the contract requiring the contractor to give a separate schedule outlining the expected order and delivery dates of each piece of equipment used on the project. To avoid any misconceptions, it is important to clarify in the contract terms which equipment components are significant.

Contract Schedule Constraints

The contract contracts may be created to include specific timetable requirements that demand construction activities be finished before other activities can begin, or sequences that must be followed to avoid disrupting other operations, during the design phase of a project. This kind of circumstance is more common during renovation projects than during the building of new facilities. These rules may not be followed in the contractor's first schedule submission.The contractor may claim that the owner waived the contract requirements by accepting the schedule and that, as a result, the owner now owes an equitable adjustment in order to re-establish these constraints. This could happen if the owner accepts the schedule without the constraints and then later tries to enforce the contract requirements. All restrictions should be thoroughly examined by the owner and designer to see how they will affect the contractor's operations. To guarantee that a comprehensive list of restrictions is included in the contract terms, this must be done during the design process. Constraints on the contractor often result in more money spent and more time needed to do the job.

Sequestering Float

Sequestering float is a method of creating a construction schedule where most tasks have little or no float. Because the non-critical pathways have very little float, such as less than five or ten days, the outcome is a timetable with many critical paths or one critical path with numerous additional paths that are near critical. Schedules for construction with a lot of sequestering float are susceptible to delays. Any owner intervention with the contractor's activities raises the possibility that the contractor may file claims against the owner for extra expenditures.

The construction schedule may also include preference sequencing, in which tasks that may be completed simultaneously are shown as sequential rather than concurrent. Reducing float in the network by showing operations sequentially rather than concurrently results in more essential activity. To assess fake activity durations, the construction timetable should be carefully examined. For instance, an activity that is advertised as having a twenty-day length may only need 10 days, which would decrease network float. A non-sequestering float language may be included in the contract terms to reduce issues with sequestering float. A clause of this type might say something like, Pursuant to the float sharing requirement of the contract documents, the use of float suppression techniques such as preferential sequencing or logic, special lea flag logic restraints, and extended activity times are prohibited and the

use of float time disclosed or implied by the use of alternative float suppression techniques shall be shared to the proportionate benefit of the owner and contractor.

Schedule Updates

A project's initial timetable, which was usually sound, sometimes deviates into one that is impossible to maintain because of sloppy modifications. There is a propensity to apply restrictions to represent the real work when adjustments are made throughout construction. Activity limits like start-to-start and finish-to-finish virtually always result in illogical reasoning, which often causes misunderstanding and mistrust of the timetable. It may be beneficial to evaluate the update process with the owner, designer, contractor, and any significant subcontractors. The communication between all stakeholders will be improved, and there will be less surprises when the schedule modifications are given. The limitations on the activities are often removed by the conversations. It is advisable to avoid using activity limits while creating the first schedule or when creating schedule modifications.

Relations with Contractors

During the building phase, construction contractors take the main position; nevertheless, the owner and designer also play a crucial role. For the project to be completed, a collaborative atmosphere conducive to cooperation has to be created. Compared to other industries, the construction business is distinctive. Because every construction project is unique, there are many different trades involved, projects are planned and completed quickly, and there is a wide range of materials and equipment that has to be installed. Additionally, a lot of the labour is done outside and construction employees often lose their jobs due to self-employment. Due of these circumstances, managing the building is difficult, and participant collaboration is crucial. All interactions with contractors must be respectful, consistent, fair, and firm. To earn the respect of others and persuade them to accomplish what has to be done, one must behave oneself professionally. It is sometimes necessary to be aggressive without being unpleasant, and other times to be quiet without being a pushover. To operate in a construction setting, one must learn how to interact with people and know how to respond in any circumstance. Due to the nature of building projects, disputes and confrontations between people do sometimes occur. One must understand that fights and disagreements are not always negative since many brilliant ideas have come about as a consequence of confrontations. The mind-set that ought to rule is that diplomacy may turn conflicts into accords. There are instances when adopting a neutral stance could be preferable. Contractors are autonomous commercial entities that are solely needed to provide the contract's final product or service. There are instances when an owner and a contractor may not agree, but getting the job done should always come first. The contractor's skills, labour, and equipment are used to their fullest potential when there is a good owner-contractor partnership.

Dispute Resolutions

Contractors, owners, and designers will virtually certainly be engaged in conflicts given the nature of building projects. A conflict may be settled by discussion, mediation, arbitration, or litigation, among other options. Direct talks between the disputing parties might be arranged to address the issue honestly and find a solution that will satisfy everyone. There are often no additional parties involved. Through mediation, disagreeing parties are given the option of working with an impartial third party to help them reach a resolution. A final decision cannot be made by the mediator. The main difference between mediation and arbitration is that the arbitrator has the power to provide a final, binding judgement that cannot be challenged by any party. A panel of arbitrators may be used in certain cases to settle disputes. Litigation is the process of resolving conflicts via lawsuits that follow the official procedures of the

judicial system. Generally speaking, compared to the other techniques, this one takes a lot longer and has much greater legal fees. Negotiations are often the fastest and most cost-effective method for resolving disputes since factual issues may be handled without adhering to formal legal procedures. ~The parties participating in the lect have voluntary informal lect talks at mutually convenient times and locations. Each party's representative must be able to speak for their organisation on the negotiating table. The intricacy of the topic determines the size of the negotiation teams; nonetheless, efficiency is often greater with fewer people participating. The degree to which the contract decisively resolves the problems at issue in the disagreement, the level of preparation made before to the negotiation, and the desire of both parties to engage in good faith negotiations all affect how well the negotiations proceed. Direct discussions between the parties may improve their successful business relationships. Mediation is often the next best course of action when direct discussions fail to produce a resolution. Similar to negotiation, mediation is voluntary, so both parties must agree to have the mediator act as a catalyst to explore potential solutions, to gather information and resolve misunderstandings, and to influence the parties to adopt flexibility in their positions in order to reach a final settlement.

The disputing parties and the mediator may meet in public or in secret throughout the procedure. Both parties to the dispute mutually agree on the mediator. A public-service, non-profit organisation called the American Arbitration Association (AAA) has set standards and regulations for mediation. Arbitration is the process of submitting a disagreement to a mutually chosen, neutral a third person whose judgement is enforceable and legally binding. An arbitration provision is often placed in a contract's general terms in order to employ this approach, therefore the parties acknowledge and agree that any disputes will be resolved by arbitration upon the execution of this Agreement. The articles that make up the Construction sector Arbitration Rules, developed by the AAA, are now the most well-known arbitration procedures in the construction sector. The steps are as follows: agreement to arbitrate; choice of arbitrator; hearing preparation; hearing of the dispute and award. Within 30 days after the hearing's conclusion, the arbitrator typically renders his or her ruling. As a result, judgements are reached far more quickly than via litigation.

Since litigation is the most expensive, time-consuming, and difficult means for resolving disputes, most parties attempt to settle disagreements before taking them to court. The interests of the parties are represented by legal counsels who adhere to the rules of the legal and judicial systems. A legal tribunal decides the dispute's ultimate conclusion. Frequently, an agreement to resolve the conflict is struck shortly before going to court. Avoiding and Resolving Disputes during Construction is a brochure published by the American Society of Civil Engineers that outlines a way for fostering cooperative, problem-solving attitudes on projects via a fundamental risk-sharing concept between the owner and contractor. It outlines unique contract clauses and procedures that have been successfully used to hundreds of projects to prevent or settle conflicts without going to court. These three clausesDispute Review Boards (DRB), Escrow Bid Documents (EBD), and Geotechnical Design Summary Reports (GDSR)are thoroughly explained and advised on all projects with a high risk of significant conflicts. A three-member DRB that is established at the start of construction helps to prevent disagreements and, in the event that they do arise, offers prompt and fair suggestions for non-binding remedies.

The contractor's bid papers may be reviewed to create a trustworthy database that can be used to negotiate price modifications and settle disagreements. The contractor's entitlement to compensate for significantly different site conditions is acknowledged by the inclusion of the Federal Differing Site Conditions provision and a GDSR in the contract. This also creates a

clear geotechnical baseline to detect different site conditions. Along with implementation guidelines, these requirements are included in the brochure[4]–[6].

Job-Site Safety

Like planning, scheduling, estimating, cost management, and other aspects of project work, safety is a crucial component of project management. Safety must be prioritised at all levels and throughout the whole project. Accidents have an impact on both workers and their families. The financial expenses, liability repercussions, legal obligations, and corporate reputation all highlight how crucial project safety is. There are many fundamental ideas and methods that may be applied to safety that were previously discussed in relation to project management. Every stage of a project's design and construction should take the aspect of safety into account. Safety is not something that is added to a project by mistake; it has to be planned for and managed just like scope, budget, and schedule. Due to the nature of the activity, construction entails several potential risks for both equipment and personnel, including heat, noise, wind, dust, vibrations, and poisonous chemicals. The federal government established the Occupational Safety and Health Administration (OSHA) as a regulatory body to guarantee worker safety. It is applicable to everyone participating in a project, including the designers, owners, employees, and contractors.

Despite the fact that OSHA and other laws have been passed for safety, management is still in charge. The project manager must collaborate closely with the other members of his or her team to include safety into all project phases, including planning, design, budgeting, and construction. Starting at the top of the organisation, safety should be ingrained at every level of management down to the crews and employees on the job site via words and deeds. Despite the fact that the contractor is now given ultimate responsibility for construction safety, there should be a coordinated team effort to comprehend and put into practise a safety mind-set that enhances job-site safety[7]–[10]. Medical expenses, premiums for compensation benefits, liability, and property damage are all included in accident costs. In recent years, these expenses have increased. Accidents often result in other substantial expenditures, however. These expenses include missed wages for the wounded worker, lost wages for other workers who had to miss work due to an accident, and lost supervision time.

The focus of everyone must be on safety. According to research, managers of safer work sites deliver higher results. They do a better job of keeping labour costs down and projects on time. These facts run counter to two justifications managers sometimes cite for a poor safety record: accidents are unavoidable in a hazardous business-like construction, and finishing the project must come first. These managers are duped by urban legends that may be quite expensive for the project and the business. Productivity and safety on the work site should be managed as two interrelated components of great job performance. It has been said that a successful work site manager once said, you don't have to trade production for safety. The staff will work more quickly the safer they are. You may be more productive the safer you are. Prequalification of contractors is often determined by their bonding capacity and prior work history. The building company is often chosen based on the prequalified contractors' lowest bid price. Perhaps a contractor's safety record should be taken into account as a mandatory component of construction bids, and a bid might be rejected on the basis of an unsatisfactory safety record.

Management of Changes

In order to finish a project, certain adjustments must be made while it is being built. The owner, designer, or contractor may be the cause of the alterations. After construction is finished, an owner could want to make a modification to more effectively employ the project

for their intended purposes. Because it is not always feasible to forecast all the events that will emerge throughout the construction process, a designer or contractor may desire to make changes to the original plans or specifications. Changes thus occur throughout construction virtually often. The change-order, a form that is used to make modifications during building a documented account of the changes made to the work. The initial bid paperwork, together with any authorised modification orders, serve as the legally enforceable contract documentation for the project. Despite the fact that a change-order may raise or Most change orders affect a project's cost and/or schedule by adding to the cost and/or delaying the project's completion. Therefore, every project manager must exercise caution when handling modifications during construction since a change in the work nearly always has a negative impact on the project's budget and schedule. If changes can be foreseen in advance, management of such changes is substantially improved. Before construction starts, there are several variables that may be identified that serve as early indicators of project alterations in the future. According to research, lump-sum projects with a big cost differential between the lowest and next highest bid amount often see significant cost rises. The phrase money left on the table is often used in the construction business to refer to the gap between the lowest bidder's offer and the bid of the next highest bidder. Because high money-left-on-the-table is a sign of potential cost escalation, a project manager should put more effort into monitoring and regulating the project. A monthly request for a list of expected change orders is one method for managing modifications during construction. In order to assess the necessity for and/or usefulness of the change, the project manager or his or her assistant first consults with the party expecting the change. When the complete impact of a change is contrasted to its genuine worth, an honest examination of its merits might sometimes lead to the conclusion that the change is not actually essential.Because changes to one component of a project often have an impact on other sections of the project, every facet of a modification must be carefully considered. Sometimes the entire effect on other project components is unknown until a later time, which might have a negative impact on the cost in the project's later stages. A change that happens later in the project as a consequence of a change made earlier in the project is sometimes referred to as having a ripple-effect. Changes during construction should be avoided unless they are absolutely essential. If a change is required, it must be carefully considered, precisely specified, accepted by all involved parties, and executed in the most effective and cost-effective way possible.

Resource Management

For a project to be completed, a lot of resources are required. Resources include people, tools, supplies, and independent contractors. To save expenses during construction, each resource must be controlled as effectively as possible. The most crucial resource on the project are the tradespeople who run and install machinery. These people learn their expertise via education and practical practise. As long as the necessary training, equipment, and resources are accessible when required, they are capable of completing the task. The skilled personnel are often criticised for the project's poor-quality work. Though itPeople don't often produce subpar job on purpose. Poor work is often the result of inadequate instructions, delayed delivery of supplies, unavailability of equipment, or a lack of direction and supervision. These issue-causing factors are the fault of administration of the project. As a result, the project must have a well-defined work plan that outlines both the work that must be done right now and the work that is scheduled for the future. The project's craft teams must be made aware of this strategy. The kind and quantity of equipment employed on a project relies on the project's specific requirements. For instance, a sizable spread of scrapers, dozers, water waggons, compactors, and motor patrol graders may be needed to build a sizable earthen dam. However, simply a modest front-end loader, truck, and portable crane may be required

for the building of a strip mall. Just as there has to be a plan for the employees on the project, the choice and use of equipment on a project must be an intrinsic element of the overall construction plan and timeline. The task of creating an equipment plan for the project falls on the construction project manager and his or her field supervisor. The maintenance of equipment and its downtime should be given enough attention since its unavailability may have a substantial influence on a project's timetable. The purchase and installation of materials is a significant expense for many building projects. The primary duties of a materials management system are the identification, acquisition, storage, distribution, and disposal of materials required for a construction project. By making sure that high-quality supplies are accessible when and where they are needed, the efficient use of people may be significantly improved.

The size, location, cash flow needs, and methods for purchase and inspection will all affect a material strategy. The timeliness of material deliveries to the project site is crucial since these deliverieswhether they are partial, late, or of the incorrect kindare often the root of construction delays. The building project timetable must take lengthy lead time materials into account. The contractor is in charge of making sure that the project has a well-defined materials management system and materials management strategy. For the majority of projects, the owner gives a prime contractoroften referred to as the general contractorone contract to complete the project's construction phase. The general contractor then engages a large number of speciality contractors, sometimes known as subcontractors, to do the building work that needs specialised knowledge or tools. Therefore, multiple subcontractors that work for the general contractor do a large portion of the needed work on many construction projects.In order to integrate the work of all subcontractors on the project, this multiple-contract model requires meticulous planning, scheduling, and coordination by the general contractor. This is required since each subcontractor's work often has an impact on one or more other subcontractors working on the project. For a big project that takes a long time, the owner could hire many prime contractors. The same management ideas discussed throughout this book should be applied to the management of subcontractors. Each subcontractor on the project must have a clearly defined scope of work, pricing, and timetable. Additionally, there has to be a clear interface between all of the project's subcontractors' work. The general contractor is accountable for efficiently managing his or her subcontractors.

CONCLUSION

Engineering and construction project management cannot be done without construction schedules. They are essential to the efficient management of resources, the timely completion of projects, and the success of construction operations. Construction schedules provide project managers a thorough timetable of the events, tasks, and milestones involved in the project, enabling effective planning and coordination of the building process. Schedules aid in optimizing resource allocation, reducing delays, and ensuring that project goals are achieved within the allotted time period by describing the order of tasks and their length. Project managers may see possible problems or bottlenecks early on and take steps to alleviate them with the help of effective construction scheduling. Project managers may proactively handle difficulties, make required schedule modifications, and keep the project on track by analyzing essential dependencies and possible hazards. Construction timetables also encourage cooperation and communication among project participants. All stakeholders are aware of the project timeframe, deadlines, and expectations thanks to its use as a single reference point. The building process benefits from excellent cooperation, coordination, and decision-making as a result. Another important factor backed by building schedules is cost

control. Project managers can efficiently track project expenses, monitor expenditures, and control the budget by matching project activities with budgetary restrictions. Schedules make it possible to allocate resources efficiently and find cost-cutting possibilities.The efficiency of building schedules has significantly increased because to technological advancements like scheduling software and Building Information Modelling (BIM). Real-time data, visualization options, and more flexibility in controlling and changing schedules are all provided by these technologies, which improves project results. In engineering and building projects, construction timetables are essential to the project's success. They provide a project execution road plan, maximize resource allocation, improve communication, and aid in cost control. Project managers may create effective construction processes, satisfy project goals, and deliver successful projects on time and within budget by efficiently using construction schedules.

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CHAPTER 4

A BRIEF OVERVIEW ABOUT BIDDING, TENDERS AND CONTRACTS

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ABSTRACT:

Contracts, bids, and tenders are essential parts of project procurement and are very important in managing engineering and construction projects. The relevance of bids, tenders, and contracts are briefly discussed in this abstract, with special attention paid to how these factors affect project success and their significance in the project procurement process.The practice of requesting competitive bids from possible contractors or suppliers to carry out particular work or deliver products and services is known as bidding. Contrarily, tenders are official proposals or bids made by suppliers or contractors in response to a client's request for bids. Contracts are written agreements that formally establish the client's connection with the chosen supplier or provider.

KEYWORDS:

Bids, Contracts, Cost, Management, Tender.

INTRODUCTION

A contract with all parties involved provides the crucial and vital backbone to any project, regardless of its potential effects on the behavior of a project's service providers and/or on the ability of the project management team to overcome any gaps or limitations in its provisions. The various forms of contracts and bids that are used often are covered in this chapter along with their benefits and drawbacks. It often occurs for a project manager to work for a firm with a well-established market presence for a significant amount of time. This alone may help to promote a certain complacency regarding tendering and contract processes that are already known from prior projects. It appears reasonable to anticipate reaching the same conclusion as they did at a different period and under a different set of circumstances while following in the footsteps of one's predecessors in writing another contract. However, it is prudent for the current project manager to examine how earlier contracts were really carried out and how their faults and flaws were resolved in order to prevent unpleasant surprises. This may be easily discovered by looking at the contractors. Engaged on the present project, evaluating their output, and taking into account how their output may be improved by the introduction of specific adjustments to tendering and/or other contract processes[1]–[4].

If close-out reports from earlier projects are sufficiently transparent and clear, a study of them may swiftly inform a project manager on the relative strengths and flaws of those projects. This makes it easier to revise the tactics to use while interacting with the different service providers. This may help the business achieve better success than it could have with those counterparties in the past. There have recently been unheard-of developments in the growth of industry due to the ease of communications and accelerating of movement between nations and continents as a consequence of cheap transportation and communications at the global level. This has encouraged the freer, or less constrained, flow of commodities and services

internationally across different countries. At the same time, this ostensibly freer trade across countries and continents has increased rivalry between businesses and international Organisations, with each trying to hold onto and grow their portion of the global market. As a result, competition has increased as each player strives to establish or seize market share with novel or distinctive products and services that outperform competitors[5]–[7].

These circumstances have opened up a whole new sector of management consulting in the domain of market strategies that take into consideration this escalating global competitiveness.

The owner of a project could get proposals from several nations. Decision-making in such a setting must be guided by thorough and unbiased information, including the most recent developments on international norms that are widely recognized. It is especially important to manage project arrangements in a way that ensures the customer's trust in a product or service since there may be a significant physical distance between the client and the engineering office or factory of a contractor. One such system will be covered in chapter eight and is that of the ISO (International standardized Organisations, a division of the United Nations). Along with these factors, the completion of a contract that was thoughtfully constructed offers an additional assurance of product-quality assurance, at the proper price, delivered on schedule. Using a tool like a FIDIC contract, which is a standard contract created by the International Federation of Consulting Engineers, helps the project achieve the intended outcome even more[8]–[11].

DISCUSSION

Project management comes into touch with the reality of the contemporary construction industry when it comes to projects that include the construction of one or more physical facilities, such as factories, offices, workshops, warehouses, oil and gas fields, or other energy generating or energy supply projects, etc. Construction contracts are typically, at least initially, a three-way arrangement. Between the owner and the principal contractor on the one hand, and between the owner and the supplier of engineering services on the other, there are two major contracts (Figure 1). Of course, the engineering company and/or the contractors also have agreements with subcontractors to deliver goods or render services.

The overall project will be impacted by all of these contracts. In order to achieve a quick response, speed performance, or ensure quality-of-service in the maintenance of the engineering firm's computer systems, for instance, the services for an engineering firm might be provided by a company that maintains their computers but with whom there is no legally binding contract.

This would cause the overall design time to exceed what would be anticipated if such a third-party service provider were not involved in the process. In other words, a contract between an owner and a contractor may seem good on the surface and be apparent to both parties as to all of its implications. However, additional arrangements between the owner or contractors and individuals who are not directly party to their contractual connection, or for others whose relationship with them is not tightly governed by contract, might prove to be quite troublesome. The skilled and vigilant project manager takes sure to look out for and avoid such potential minefields that are concealed. Every contract is crucial to the project, and everyone should be aware of its purpose.

However, the riskiest contracts are sometimes the most crucial since they typically include the biggest financial investments in the project, notably the building contract between the owner and the primary contractor. The sort of contract, how each contract differs based on the

project's nature, and its goal must all be determined by the owner. Formal owner-contractor agreements may take many different forms and sizes. The following are the most often observed:

1. Measured contract.
2. Lump-sum.
3. Cost-plus contract.

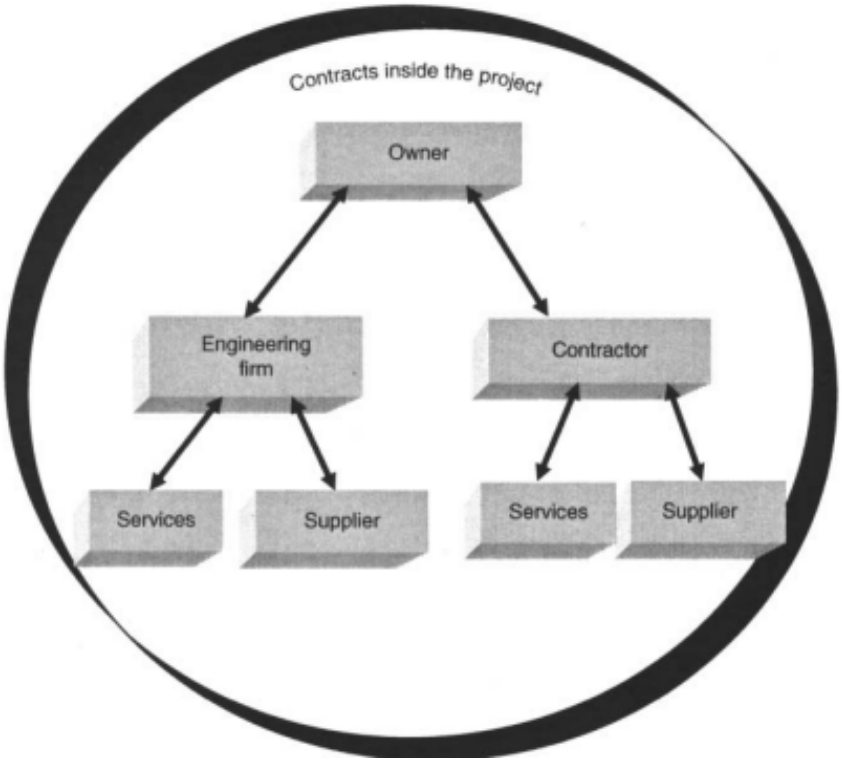

Figure 1: Represting the Contracts inside the project[AccessEngineeringLibrary].

The Measured Contract

This kind, one of the most popular in the building industry, has developed a solid reputation through many years of usage in a variety of situations, including both stable and unstable social and economic conditions. Quantities of each item are included in the contract paperwork, along with precise descriptions and detailed specifications. When calculating the item's overall cost, the contractor multiplies the price of each item by the amount.

The sum of all these costs is the overall project cost. The benefit of this strategy is that any effects on the price of this item, which was predetermined on a basis specified in the contract, can be easily ascertained, as can any shortages or increases in quantity. The inclusion of a fixed price throughout the project time has recently come to be considered as a possible source of harm to the interests of the contractor, who receives little to no specific protection under this form of contract, in light of increasing pricing and other continuous market developments. A widely-used international commercial practice has emerged whereby, in the case of a project whose execution exceeds twelve months, a clause in the contract provides for allowing increased prices for labour, materials, or tools. This is because contractors have become reluctant, or have even refused, to tender for contracts that have not provided some safeguard against rising costs. In European nations, the Department of Environment and other governmental agencies produce a bulletin each month to explain pricing increases.

The Lump-Sum Contract

Historically, low-cost projects have employed this kind of contract. In this agreement, the contractor will carry out the job for a set fee. Because there is no quantity computation in this contract, the drawings and specifications must be unambiguous.Therefore, it may be challenging to estimate the amount of variation cost when the location changes. Due to this situation, talks between the contractor and owner may drag on and damage the project as a whole. Modern versions of this kind of contract describe the engineering, procurement, and construction (also known as EPC) at one location at the same time as a turnkey solution. It fosters intense rivalry among contractors, especially in a project's design area. One is due to the fact that one aspect alone may considerably lower a project's overall cost. The advantages the owner, who may anticipate beginning to realize profit from the project's entry into actual operation that much sooner and at the lowest cost. Of such a development are unavoidably to return to the owner.

The ability to divide big expenditures or milestones, such as the purchase, delivery, and/or installation of equipment on-site, is another crucial feature of the lump-sum contract. In this situation, a contractor might be interested in dividing this cost into separate amounts to represent the costs of providing the machinery's concrete base, performing mechanical work on the equipment, supplying and installing the machine, and finally attaching the machine to an external source of electricity.

The contractor and project owner may be able to allow themselves leeway to negotiate their way around the impact of any unforeseen price rise in any one of these things by thus breaking out the price of each component item of activity separately in this manner. Some contracts additionally include an appendix that lists the cost of goods or labour per day that is likely to cause this activity to grow or decrease.

The Cost-Pius Contract

For the course of the project's construction, the contractor will provide construction at its real cost plus a predetermined ratio. This latter sum comprises profit and supervisory expenses. This is set throughout the length of the project, provided price increases do not cause an issue.

The primary drawback of this sort of contract is the amount of supervision necessary, which includes daily inspections of the facility, staff, and supplies. Cost-plus agreements are often utilized for projects that need to be completed quickly, urgently, on a very small scale, or that are of great significance. For urgent objectives, they often need materials delivered in distant locations. These contracts are often used in oil and gas projects since they frequently call for quick action to address some unforeseen issue or other. The bills from the suppliers reveal the cost of the materials, and the contractor receives the predetermined set proportion.

Contracts between an Owner and an Engineering Consultancy Office

The Engineering Office provides a thorough description of the services to be supplied, and this contract is based on several defined criteria. The anticipated value is often within 7% of the project's overall expenses for smaller consultancies and within 5% of the project's total costs for bigger corporate entities in companies of European and Arab nations. Based on project size, the Engineers Association has determined these percentages. There can be extra charges for facility usage, travel, and other supervisory costs whether the contract is for design services alone or design services with some on-site supervision activities.In certain projects, supervision costs could be fixed rather being calculated as a percentage.

This kind of contract is often based on the price of man-hours used in large projects. The lead engineer, senior, junior, and drawing hourly rates are all specified in the contract. The total cost of the project is calculated by counting the hours that each group spent working on it. Any administrative, insurance, tax, or other costs are included into the pricing, which is based on an hourly rate. The advantage of contracting on this basis of man-hours for the engineering office arises when the owner asks revising any aspect of the study design or adding another component that was not initially included in the scope of work supplied to the engineering office. The extra cost may be simply computed since the office gives a certain number of hours for each member and the rate is already a known figure.

The Importance of Contracts for Project Quality Assurance (QA)

There are various types of contracts between the owner and the contractor as well as between the owner and the engineering office, and bugs in the contracts can result in issues that may be challenging to resolve, taking up valuable time and affecting the project's final cost. Periodic particular reviews provide a crucial way to keep a successful contract that completely fulfils all requirements so that you may prepare for this possibility in advance. And knowingly. Including amount in addition to the drawings and requirements.There are some other fundamental items that are frequently overlooked when contracts are being written, such as the specifications of the onsite working conditions, the cost of the materials, labour, and tools, the price for the materials, labour, and tools, and the price. as well as the definitions of the working relationships to be maintained between the owner, the contractor, supervisory personnel, and the engineering facility. Other administrative matters, such as the health, safety, and environmental (HSE) standards that must be adhered to, the precautions to be taken to ensure employee security, the methods to be used to manage potential costs associated with accidents or illnesses that may occur on the job site, the sums to be set aside to pay for taxes and other government fees, the legal and/or judicial processes to be used in the event that a dispute between contracting parties cannot be resolved through mutual consent, and other matters, are no less significant.

The FIDIC instrument, which includes precise forms covering these and other similar issues, serves as an illustration of a stable regime for international contracts. Major multinational projects employ FIDIC as the de facto reference norm for contracts between nations.

Table 1: Cost, time, and resource estimate sheet.

Client		**Project number**	
Project title		**CTR number**	
CTR title		**Start date**	
Revision		**End date**	
Scope:			
In this section the scope of work will be written in summary but should be precise.			
Assumption:			
The assumption that the designer will take into consideration that according to these paper the client will accept and review that.			
Inputs:			
In this item will be the input data which will be the SOR from the client, soil data, survey maps, and other data that the client should deliver to the engineering firm.			

Contracts in ISO

In ISO 9001, procedures regarded as best practises for contract reviews are outlined. The following elements are covered by the ISO requirements for creating and evaluating contracts:

1. Contracts document.
2. Review contracts.
3. Procedures.
4. Requirements.
5. Capability of contractors or service provider.

The contract papers itself may make reference to or include portions of the ISO standard. The contract agreement must include plans to assess the deliverables' quality as well as a quality plan from the contractor or supplier. It is highly advised that the parties carefully check the contract before signing to make sure that all obligations are spelt out in it. The vendor or contractor must be able to show they have the skills necessary to complete the if there are any additional requirements that go beyond the main scope, the contract. This added scope has to be agreed upon and included in the final agreement.

Bids and Tenders

The next stage of the intricate administrative work begins once the project and its scope have been established, all drawings and requirements have been gathered, the kind of contract has been chosen, and the contract's final form has been decided. The project manager learns about the legal framework for contracts and project bids in each nation during this phase. Different approaches may be used in this area to lessen unfair or unauthorized manipulation of the project and/or its contractual arrangements. This is also the area where potential or real corruption may be contested, disclosed, or prevented, ensuring continued and assured fair competition amongst contractors.Most nations have rules that encourage local construction enterprises while simultaneously allowing multinational construction companies access to their markets. Understanding the legislation regulating tendering and bidding processes is crucial to understanding this area of a project manager's duties.

This has an impact on the project's principal goal of hiring a service provider that can achieve its goals while providing the requisite quality at the lowest cost. Although many nations share many of the same core concepts and practices of business law, each one has its own unique characteristics and applications. Because of this, it is not unexpected to see multinational corporations doing business in several nations depend on a contracts department that can handle contracts and bids in accordance with the unique legal requirements of each nation's contract law and tendering processes. The overall structure of the many tender types, the requirements to be met, and the features of each form of bid are all well-established. Among the primary categories of tender, there are some distinctions in the budgetary constraints and operational specifications. The following four primary kinds are covered:

1. Public (open) tender.
2. Limited tender.
3. Negotiated tender.
4. Direct order.

Public (Open) Tender

The owner creates lists of the works and accessories, as well as the service terms and conditions handbook. These papers need extra attention during preparation. The contract's

terms, as well as its administrative, tax, insurance, and succession obligations, must all be preserved in writing. English is the language that contracts are written in and are standardized on. The basic terms and conditions of the contract are included in translated brochures, and in the case of foreign bids, they specify if Arabic, French, Chinese, or other texts are applicable in the event of a dispute or ambiguity over the content. Newspapers publish advertisements for open bidding. The declaration submitted to tender, the deadline for submission, the work needed, the amount of the primary and final bond, the cost of a copy of the tender terms, whether external tenders must be advertised in the owner country and abroad, and any other information the administration deems necessary for the work should all be included in this timely advertisement.

Typically, a period of at least thirty days from the date of the initial notice of the auction is available for public tender for bid submission. A licensed competent authority may decide to cut the time in half if required, but only by a maximum of fifteen days. Public tenders for the supply of yearly supplies do not have to meet these standards unless in extraordinary circumstances necessitated by the topic of the tender and with the authorized supreme authority's approval. The duration of a tender's validity typically runs from the date fixed for the opening of the envelopes at auction until notification of acceptance prior to the expiry of the tendering submission deadline, unless the body administering the tender's auction promptly requests that bidders accept some extension.

The chain of custody of a company's tendering documents is tracked by a designated employee from the time they receive final approval from the relevant department to proceed until the documents are delivered to the location where the tendering auction will take place. Though this crucial duty may also require notifying a designated responsible person from the auction-managing authority of impending delivery, this delivery is often arranged for the afternoon or morning before the bids are set to be opened. Fairly near to the time formally scheduled for opening the envelopes, of his company's offer. The chairman of the committee in charge of handling the auction's formalities is charged with the following on the day set aside for opening submitted bids:

1. Verify the integrity of the seals on the bidding documents received.
2. Establish in the minutes of the meeting the number of envelopes received.
3. Open the bids sequentially, assigning each opened envelope its uniquely-identifying serial number.
4. Enumerate the components of the tender.
5. Read aloud the name of each bidder and title of their tendering document to the audience of bidders or their representatives. and
6. Announce the amounts of each bid

An initial bond equal to at least 1% of the tender value for the construction work is submitted by bidders. A winning bidder must post a bond equivalent to 5% of the project's construction expenses as soon as they accept the tender award. Usually, these procedures need to be completed within a 10-day window beginning the day after the auction. The period allotted for presenting this bond is often no more than twenty days for winning bidders who are located outside of the nation. The time for submitting the final deposit may be extended by the relevant authorities by a maximum of 10 days.) Government authorities notably promote public bids as a tool for enhancing the overall business environment. The goal of public policy is to promote the growth of new contractors while upholding an orderly, rules-based system with globally recognized standards so that domestic contractors can improve their overall performance and competitiveness in both domestic and international markets.

Limited Tender

The restricted tender is often employed in most unique industrial projects where there may be a limited number of suppliers or contractors due to their increased specialization. An ISO-compliant pre-qualification evaluation and audit for these firms should be conducted before adding the contractors to the company's bidding list. The owner already has a list of possible suppliers and contractors, unlike the case of the public tender. The restricted bid is addressed to a certain registered group of contractors that are known to have prior relevant expertise. Most commercial Organisations, as well as certain government agencies, utilised this tendering procedure to restrict participation in the bidding to a relatively limited number of suppliers and contractors with a reputation for quality work from inside and/or outside the nation. Saving time and money while starting the project is the goal. The procedures used for announcing a tender, creating a bid, and choosing a winner adhere to the approaches previously covered for public tenders. However, one key new twist in limited-tendering has developed with the widespread use of secure corporate websites via the Internet, which electronically allow the secret filing of bids.

The processes of creating, filing, and amending limited tenders have been made less expensive and, in most cases, just as dependable as the work that previously required many more human agents. This is thanks to sophisticated software that handles online many of the background functions of securing the provenance and chain of custody of tendering documents. On the Internet, an owner would often set up a website where bidders may enter and propose or modify their rates.

The bidders' ability to see the pricing of their rivals ensures that the data is very transparent. Without rumor and enthusiasm, all parties understand why a company wins the offer. All of this obviously depends on detailed descriptions of each project component and what the actual effort required to fulfil it entails. Specifically for chemical bids, oil and gas industries often employ this tender. Only a few numbers of renowned suppliers on the global market are able to fulfil the exacting and well-defined standards, making it easier for the owner to negotiate the best price.

CONCLUSION

For a project to be successful, effective tendering, bidding, and contract management are essential. They aid in project delivery on schedule, quality control, and cost management. The achievement of project goals is guaranteed by properly signed contracts, which helps to prevent misunderstandings and disputes along the road. Furthermore, well-managed contracts encourage cooperation between the project owner and the supplier or contractor. Project execution goes more smoothly and produces good results when there are open lines of communication, clearly defined roles and responsibilities, and appropriate risk distribution. Contracts, bids, and tenders are essential elements of project management and procurement in the engineering and building sector.

They provide the groundwork for accountability, justice, and openness. Project managers may choose qualified partners, provide precise project requirements, and build a strong foundation for project success by managing these procedures successfully.

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CHAPTER 5

QUALITY FROM THEORY TO REALITY AND ITS SIGNIFICANT

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ABSTRACT:

The procedures involved in monitoring and ensuring product quality have elevated to crucial issues for the survival of businesses looking to establish a privileged position at the local and worldwide levels. This is the driving force behind the rising interest in and demand for the most effective techniques for implementing Total Quality Management (TQM). The emphasis of this chapter is on quality management systems in construction projects and the roles and responsibilities of different stakeholders in maintaining project-wide TQM. Any company that wants to expand in the open marketplaces of today, competing and working together to share the local and global markets, has a stake in implementing TQM at all times.

KEYWORDS:

Control, Quality, Project, Project, Standards.

INTRODUCTION

Any project, product, or service must have quality as a core component if it is to satisfy customers and be successful. The idea of quality changes from theoretical frameworks to practical application in real-world initiatives, going from theory to reality. Understanding the idea of quality and its numerous aspects is the first step on the path from theory to practice. In addition to fulfilling specified standards, quality also refers to providing value, dependability, performance, and satisfying consumer expectations. It entails upholding standards, using best practices, and improving continuously. Theoretical frameworks that give direction and fundamentals for attaining and maintaining quality include Total Quality Management (TQM), Six Sigma, Lean concepts, and ISO standards. These frameworks place a strong emphasis on the value of a methodical approach, continual process improvement, and a quality-oriented organizational culture[1]–[4].

The ultimate measure of quality, however, is how well it performs in actual projects and operations. The process of turning theory into practice is fraught with difficulties. The availability of resources, time limits, budget restrictions, and changeable project settings are examples of practical constraints that might make it difficult to achieve the necessary degree of quality. A thorough awareness of project needs, stakeholder expectations, and the capacity to strike a balance between quality, money, and time are all necessary for putting quality into practice. To guarantee that quality requirements are fulfilled, it includes competent project planning, implementation, monitoring, and control. Quality is also an ongoing endeavor rather than a one-time success. It requires a dedication to constant observation, assessment, and development. To find areas for improvement and implement corrective measures, Organisations must set up feedback loops, carry out routine audits, and participate in continuous learning. The cooperation and coordination of several stakeholders, including project managers, team members, suppliers, and customers, is necessary to execute quality in

real-world projects. Successful quality implementation depends on effective communication, teamwork, and a common knowledge of quality requirements[5]–[7].

The transition of quality from theory to practice is a dynamic and difficult process. To produce the appropriate degree of quality, it necessitates the application of theoretical frameworks, the adaptation of concepts to actual circumstances, and the dedication of all project stakeholders. Organisations may close the gap between theory and practice and produce effective project results by comprehending the obstacles, putting best practices into practice, and promoting a culture of quality.The integration of quality management practices into the project lifecycle is essential for the effective use of quality in real-world projects. This entails including quality planning into the project's initial planning stages, carrying out quality assurance tasks while the project is being carried out, and performing quality control to ensure that the deliverables satisfy the necessary requirements. In the process of moving from theory to practice, the importance of organizational culture and leadership cannot be understated. By promoting a culture of responsibility, continuous improvement, and unrelenting pursuit of perfection, leaders must promote quality as a fundamental value. Organisations may foster a culture where quality permeates every facet of project execution by setting the example at the top and allowing staff to own quality.

When it comes to excellent implementation, the use of efficient tools and methods also helps to close the knowledge gap between theory and practice. Checklists for quality, inspections, statistical analysis, benchmarking, and customer feedback methods are a few examples of these resources. The capacity to detect and monitor quality metrics in real-time may be further improved by using technology and digital solutions, allowing for prompt interventions and assuring adherence to quality standards.In the end, a comprehensive and multifaceted approach is what will enable great implementation to successfully translate theory into practice. Combining knowledge, skills, procedures, tools, and a dedication to ongoing development are necessary. Organisations may offer goods and services that meet or exceed consumer expectations, improve their reputation, and promote long-term success by adopting quality as a core component of project management[8]–[11].

DISCUSSION

Any equipment may now be acquired from anyplace thanks to globalization. How can the buyer be certain that the product has the necessary quality and is able to provide the customer with anything they need within the time frame specified in the conditions of a contract that both parties have agreed to? A quality management system that may inspire trust from the customer Risks associated with the project should be reasonably reduced. In today's commercial climate, engineering, vendor, and owner-contractor Organisations are transnational. The Middle East, Asia, or Europe may have branch offices that report to the main office in the United States. Quality management difficulties must be resolved if present or potential customers are to feel confident in the services, they are receiving from a location that may be thousands of miles away from a project site. This will help the business preserve its good name. Given these conditions, there has developed a growing dependence on and emphasis on internationally recognized standards as the main objective criterion supporting a provider's commitment to offer the level of quality that a customer expects. This is reflected in the standards created and maintained today by the International Standards Organization (ISO), a division of the UN.

However, there was no generally acknowledged third party creating or supporting objective but publicly supported engineering quality standards criteria until a decade after the conclusion of World War II. Today, this trend has progressed to the point where widely-

accepted specifications have been created for the construction and installation of manufacturing equipment and facilities of every variety, incorporating the highest levels of quality assurance compatible with generally manageable levels of capital investment.

The British Standards Institute, which had been releasing a variety of instructions on how to attain the BS4891 quality assurance, was the Organisations that started work on these standards in the United Kingdom. After some time, a variety of acceptable papers that suited the requirements of the manufacturer or supplier were produced. Thus, the BS5750 standard started to take shape and was eventually published in a series in 1979. Both internal quality management in a supplier Organisations and quality assurance of the product for customers of a manufacturer were given direction by it.

The manufacturers, suppliers, and consumers of the United Kingdom quickly began to embrace this norm as the industry benchmark. The British requirements are regarded as the starting point for any European specifications at the same time as the American National Standards Institute started working on a standard called "ANSI 90" for enterprises in the United States.

The ISO 9000 Standard

The International Organization for Standardization (ISO), a United Nations agency founded in 1947, entered the picture as the only body that could be relied upon to publish others' standards and maintain thorough translations of them across the major UN languages. With time, the ISO's operations expand, and it publishes a large number of standards. Due to the interest from manufacturers, their foreign agents, and consumers, the standards have spread globally. In order to satisfy the consumer, the producer offers a product, which boosts production and sales. Representatives from 163 nations make up the ISO, the majority of which already employ BSI and ANSI standards. The operations of the ISO have grown throughout time, and numerous specialized requirements have also come to be published under their umbrella, relieving other nations of the burden of translation. British standards BS5750, parts 1, 2, and 3 were quickly followed by the 1987-released ISO 9000 definition. To show the fundamental ideas and various applications that may be utilized in a series of ISO 9000, the same general Organisations of the components and the ISO increased were used as a general reference.

The European Committee for Standardization's board decided to align its work on standard specifications with the guidelines outlined in ISO 9000 on December 10 of that year. It was released under the heading EN29000 1987 after being approved as a standards specification for European nations without any further changes or adjustments.

These European standards have English, French, and German as their official languages. Following that, this Organisation decided to publish and translate these specs according to each country's language.

The next significant advancement for this standard occurred in 1994, when roughly 250 items were changed. These revised articles are simpler to read than the originals and provide clarification of the standards. ISO 9000 is broken down into sections 9001, 9002, and 9003 in order to clearly define quality assurance details involving the design, the production, and the approval of a finished product. According to market demand for the major product lines already on the market, factory circumstances, and current conditions most likely to be faced with current technology, ISO 9004 comprises the fundamental guidelines for the creation of the Total Quality Management system. Technological options.

Quality Management Requirements

The quality management regime described in ISO 9000 is a system of interconnected resources, tasks, and responsibilities that offers procedures and means for fostering or maintaining trust in any provider who complies with its demands to provide products and services that meet marketable quality standards.

Quality Manual

The official documentation of a company's quality management system is found in its quality handbook. It could include the following:

1. A rule book by which an organization function.
2. A source of information from which the client derives confidence.
3. A vehicle for auditing, reviewing, and evaluating the company's Quality Management System (QMS).
4. A firm statement of the company policy towards quality control (QC).
5. A quality assurance (QA) section and description of responsibilities.

In my capacity as the process, review, and quality system commander. Models of documents as well as models for the registration of the test results. The necessary documents to determine how to follow up on quality.

Quality Plan

The quality plan outlines the actual procedures that must be followed in a certain sequence in order to achieve the desired level of quality for the project. The quality plan differs from project to project depending on the specific conditions of the agreement with the owner or the customer. It should include the materials to be used, the kinds of workers, and the tools needed to carry out the contract's quality objectives. Everything is described in great depth, including a plan for testing and evaluating how far the contract has come in achieving these objectives. The quality plan is rigid and cannot be changed until the project is completed.

The quality plan must specify the specific measures to be followed to achieve the objective in cases when contracts demand that a buyer, customer, or owner include unique criteria necessary for producing the intended result. The purpose of presenting this plan to the customer is to increase confidence in the supplier's capacity to provide the necessary product at the desired standard. The quality Programme consists of: all controls, processes, inspection equipment, manpower sources, and skills that a company must have to achieve the required quality

1. QC inspection and testing techniques that have been updated.
2. any new measurement technique required to inspect the product.
3. measures that remove potential sources of conflict between inspection and operation.
4. standards of acceptability for all features and requirement that have been clearly recorded.
5. Compatibility of the design, manufacturing process, installation, inspection procedures, including all applicable documentation readied before production begins.

Quality Control

According to ISO, a set of procedures, tasks, or evaluations must be carried out in a certain order to produce goods that meet the standards for quality. The end result of construction projects is a building or structures that are functionally sound. Setting the degree of supervision for each project phase is the first stage in quality control, which ensures that

every component of the project is carried out correctly and in accordance with the necessary requirements. Building and structure design, construction, and usage must all be as consistent as feasible with the project's requirements. Keep in mind that the project-delivery Organisations, from the manager on down, is responsible for quality control. In actuality, the department head and the construction managers have been assigned the duty of quality control.

Why Is Quality Control Important?

There are several advantages to quality enhancement. Making sure that work is done properly decreases errors, which reduces the need to repeat jobs, saves waste, and keeps project expenses in check. An environment like this may help the business become more competitive by boosting productivity and worker morale. Take into account two crews with comparable size, expertise, and job activity.

The first crew benefits from having someone in charge of quality control, but not the second. Before continuing with the project, any errors may be fixed. On the other hand, any flaw in the second crew's work will likely not be found until after it has been finished. This work's flaw will either be removed or fixed, or it will be overlooked and kept in place.

The owner will feel some level of unhappiness as a result of all these issues as building moves forward. Customer discontent may potentially result in the Organisations losing out on future building contracts or necessitating expensive remedial measures. Defects come with a price: the person who committed the error received payment, and the person who repairs it will also accept payment, and extra material and equipment costs will be necessary.

Take the well-known instance of the New York City parking garage that partially collapsed. This disaster was brought on by the lack of reinforcing steel in three of the six cast-in-place column haunches that supported the major precast girders. Reinforcing steel was supposed to be put at these points, according to the project plans and the rebar shop drawings, however it was unintentionally overlooked. As a consequence, additional work that was required to remedy the job and fix the damaged post had to be done at the contractor's cost. When a commercial complex was being built in Qatar, another significant quality error was made. They discovered that around 40% of the columns had a strength that was less than the permitted strength after pouring the concrete for the columns and the slab. Therefore, since there was no concrete quality control on site and the workers lacked expertise, the project was delayed and the cost of the repairs was high. To save expenses and save time, quality is often compromised. Quality does, however, result in time and financial savings. Nothing reduces time or saving money by avoiding expensive procedures of correction from the start and doing the task correctly the first time.

Submittal Data

One of the first phases in the quality control process is to analyses the project's submittal information, including shop drawings, work samples, test results and other performance information concerning the materials to be used, Letters of Certification, etc. It is necessary to confirm that the details obtained from suppliers and subcontractors on the components that will be placed into the project adhere to the requirements stated in the contract agreements. A number of factors should be examined and confirmed, including dimensions (thickness, length, and shape), ASTM (American Society for Testing Materials) standards, test results, performance specifications, color, and collaboration with other trades. Checking shop drawings is especially important since they fill in information on the specifications for concrete reinforcement, structural steel, cabinets/millwork and lifts that may be lacking from

contract drawings. The information supplied on the authorized shop drawings is what the fabricators use to "custom make" their products, therefore this warning is particularly relevant for projects involving things that were initially made off-site. The contract plans and requirements must be compared to each item on the shop drawings. The project's compliance with the necessary quality control standard is decided after a thorough examination of the submission data.

The general contractor reviews submissions, and the consulting engineer then reviews them. The submission data's original submitter is required to resubmit updated or extra information if the data isdisapproved or lacking. The template from which further-required materials will be manufactured is a submission that concludes the review procedure. Any errors that are missed throughout the submission review procedure might possibly result in issues requiring more money and time for repair. A subpar shop drawing assessment may have devastating results, as seen by the 1981 walkway collapse at the Kansas City Hyatt Regency. The load on the fourth-floor walkway connections was doubled as a result of an uncontrolled alteration in the structural connections' specifications. Due to this, the second-floor walkway was damaged when the suspended walkway from the fourth level collapsed. And then down to the lower level. 114 people lost their lives in this catastrophe, while 200 more were injured.

How to Check Incoming Materials

Information submitted is verified against the terms of the contract and approved before being filed for future use. Many businesses provide a reference number in their submissions. Incoming items may easily be checked against contract criteria and off-loaded at the storage location after everything checks out by comparing information contained on the delivery tickets, or manufacturer's information included in the shipment, with data from the submission. At the same time, care must be taken to prevent any "unapproved" material kept on-site from being used in the building process. If this happens, work may need to be redone or other remedial measures may need to be taken.

Methods of Laying Out and Checking Work

Maintaining the quality of the project output depends on the way the work is laid out as well as the verification of the proper placement, orientation, and elevation of the work. Incorrect placement of work, such as misplacing anchor bolts for the foundation, may result in additional costs for repairs and delays. In addition to inspecting the work, it also has to be laid out properly. For instance, a tape measure, plumb bob, carpenter's level, and chalk box are necessary equipment for installing anchor bolts in a foundation. Inspection elevations during the installation of concrete footings and completing the grade and floor are among the topics to be covered for the correct designing and inspection of the job. Windows, overhead doors, and air-handling systems are examples of ways to verify that work is being done in the field according to the manufacturer's instructions for the arrangement of certain objects. Since quality control is everyone's job throughout the building process, the majority of engineers working in construction roles will assist in managing QC responsibilities. Engineers should be encouraged to look for "key items" during inspections since it isn't always evident what has to be discovered to achieve a thorough examination.

Material/Equipment Compliance Tests

Prior to placement and after installation, testing of materials and equipment is required by every project owner. Whether or whether they will be doing the tests themselves, engineers should be conversant with testing techniques. A list of each test that will be necessary should be laid out prior to starting building activities. This will be utilized by QC professionals as a

checklist. The kind and frequency of testing necessary for each component of the task should be included on this testing checklist. After tests are completed, a test report including the test's findings should be maintained on file or placed in a folder marked "test report" for future use. The following tests are typical ones that will be carried out on the worksite to verify the caliber of the work that is installed or finished.

Soils Testing

The loads from a structure are dispersed into the earth below by the foundation of the building. The soil in this area has to be sturdy enough to support the impending loads. In order to prevent differential settling in the structure, which can lead to structural and weatherproofing issues, the strength of the soil must also be uniform. Verifying the soil's compaction is necessary to guarantee that the building structure settles as little as possible. It is necessary to verify that each excavation or soil backfill operation complies with the project specifications' compaction criteria. Prior to doing any more work, such as placing rebar, these tests are conducted.

Concrete Tests

The slump test and the concrete cylinder, or cube test, are the two kinds of concrete tests that are performed to assess concrete on the worksite. According to ASTM C 143, the slump test checks if the concrete has reached the appropriate workability without becoming too wet. The project requirements for mortar state that mortar either an ASTM C270 or ASTM C780 standard must be followed. The appropriate mortar ingredient ratios are specified by ASTM C270 as 1 part Type S masonry cement to 3 parts masonry sand. The mortar's necessary strength and the procedure for acquiring samples for compressive testing are both outlined in ASTM C780. It is necessary to get copies of these ASTM standards to guarantee complete compliance with the project requirements and industry standards.

Plumbing Tests

Leaks must be examined in the building's pipes throughout. All pressurized (supply/return/fire sprinkler) pipes must undergo hydrostatic pressure testing, which is determined by a water pressure gauge, in order to check for leaks. The pipes must typically withstand 150% of their regular operating pressure for two hours in order to pass the test. Any decrease in pressure suggests that there is a line leak. The test is rerun for two hours once this leak has been located and fixed. It should be noted that loose joints must be tightened, or they must be disassembled and fixed. An authorized rectification procedure does not include applying pipe sealant to the pipes outside.

Performance Tests

Many of the intricate systems that are placed in the building need to undergo performance checks. The fire alarm system, lifts and water chillers/air handlers are a few of these systems. Only QC staff members observe and verify these kinds of tests, which are carried out by the system installation. Once again, it's critical that QC staff members understand what goes into testing these systems. Industry standards will be included in the project requirements and must be adhered to for appropriate testing.

Quality Control Plans

Both field staff and business officials should be involved in quality control. The written reference document for the execution of the quality control Programme is provided by quality control plans. The responsibilities and operations of the quality control staff must be

described in this plan as succinctly and clearly as feasible. Due to the need to write such a plan, the following writing recommendations should be employed. The many departments engaged in the quality control process should contribute to the strategy. The employees of the field offices, the owner, the engineer, the subcontractors, and the suppliers are all included. The QC plan's creation and execution must go beyond a cosmetic correction. Even if the quality control Programme may seem effective on paper, it can only accomplish its goals if the specified quality control processes are followed every day. The individual implementing the technique outlined in the handbook must have no trouble understanding the strategy. Organizational charts displaying the line of command, descriptions of roles, guides to following processes, and samples of appropriate documentation should all be provided. All adjustments necessary to maintain efficient quality control on the project site must be included in the plan in order to keep it current. This can include making use of recommendations from the personnel in charge of QC tasks.

CONCLUSION

The process of taking quality from theory to practice is difficult yet crucial in project management. Meeting regulations, providing value, and surpassing customer expectations are all parts of the notion of quality. Theoretical frameworks provide direction, guiding ideals, and recommended methods for obtaining and sustaining excellence. The ultimate measure of quality, however, is in how well it works in actual projects. Achieving the appropriate degree of quality may be difficult due to a variety of variables, including budgetary restrictions, resource shortages, and unpredictable project contexts. Delivering effective project outputs requires balancing trade-offs between quality, money, and time.A thorough comprehension of the project requirements, as well as efficient planning, execution, monitoring, and control, are necessary for the realization of quality in practice. It entails the cooperation and coordination of the project's stakeholders, the promotion of a culture of quality, and the maintenance of good communication and a common understanding of the standards for quality.Quality is also a continuous process rather than a final product. Organisations must promote a culture of learning and innovation, embrace continuous improvement, set up feedback loops, and carry out frequent audits. In order to establish quality as a fundamental value, organizational culture and leadership commitment are crucial. The capacity to measure, monitor, and guarantee adherence to quality standards is improved by integrating quality management practices into the project lifecycle and using the relevant tools and methodologies. Real-time quality monitoring and effective interventions are further made possible by technology and digital solutions. A multifaceted strategy is necessary for the effective translation of quality from theory to practice. Organisations may close the gap between theory and practice by fusing theoretical knowledge with real-world application, leadership commitment, organizational culture, and continual development. Delivering projects, goods, and services that meet or exceed client expectations, improve the standing of the company, and promote long-term success are the outcomes.

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CHAPTER 6

ASSURANCE OF QUALITY IN CONSTRUCTION

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ABSTRACT:

In the construction sector, quality assurance is essential for ensuring that projects adhere to the necessary standards, requirements, and client expectations. The significance of quality assurance in construction and its essential elements, such as quality planning, quality control, and quality improvement, thorough quality planning, which includes identifying quality goals, setting quality standards, and creating a quality management system, is the first step in ensuring quality in construction. Key quality metrics are identified during the planning phase, together with performance standards and the processes to be used for quality control throughout project execution. To monitor and confirm that construction activities and deliverables adhere to the agreed quality standards, quality control activities are put into place throughout project execution.

This includes routine testing, inspections, and recording of quality-related operations. Corrective measures are taken to resolve non-conformances or deviations from the quality standards once they have been found, recorded, and remedied.Another crucial component of quality assurance in construction is continuous quality improvement. To improve construction processes and results, it entails analyzing quality data, spotting patterns, and putting corrective and preventative measures in place. Continuous improvement initiatives are aided by stakeholder feedback, lessons learnt from prior projects, and best practices.All project parties, including clients, contractors, suppliers, and regulatory agencies, must work together and be committed to effective quality assurance in construction. Everyone is in agreement with the project's quality goals because to clear communication, frequent meetings, and shared responsibility for quality. Additionally, using technology and digital tools may considerably improve the speed and efficacy of quality assurance procedures in the building industry. Real-time quality data collecting, analysis, and decision-making are made possible by mobile apps, data analytics, and real-time monitoring systems, permitting prompt interventions and raising overall quality performance.

KEYWORDS:

Assurance, Communication, Construction, Project, Quality.

INTRODUCTION

An illustration of the significance of quality assurance is shown below. You make the choice to work on a sewage system. You had the identical system constructed by a contracting business in great quality, according to schedule, seven years before. Without any other influence, it is your choice and you are accountable for it. Is it wise to contact this business directly or not? Why? Before reading the next paragraphs, please think about the answers to these questions. There are currently several global corporations operating in a variety of sectors, including the construction business. Therefore, every business and every one of us occasionally serves as both a manufacturer and a service provider. For instance, the

contractor firm offers the customer services, and at the same the manufacturer supplies ceramic tiles, HVAC equipment, plumbing equipment, and other materials and equipment to the contracting business in order to execute the project. Additionally, the factory that sells ceramic tiles is a customer of the business that provides mechanical spare parts to keep their machinery operational[1]–[4].

Therefore, a flaw in any one of the systems will have an impact on them all. If everyone in the firm has a solid quality system, it should go without saying that the quality system should apply to all enterprises and Organisations. To make sure that the product and service are based on needs, standards, and customer satisfaction, each Organisation should develop its own system. If the quality assurance system is effective, it will continue to function as intended even if some employees leave the company or retire. In response to the first question, if this firm is a family business run by a father and a son, and the son becomes careless and sluggish, the project may be in danger if his company participates in any project activity. In contrast, if he has a genuine quality system, you may engage with him, but you should also do an audit. For a global corporation, on the other hand, the chairman often works from a location remote from the project, therefore quality assurance will be documented for external or internal audit review. The system should keep track of and address any issues the owner has about the business. The following is the goal of quality assurance:

1. To make sure that the final product is in conformity with the specifications, and the employment is highly qualified and able to achieve a high quality of the product through the administrative system
2. To ensure the application of the company's established characteristics among all sectors in the factory, regardless of personnel
3. The benefits of the application of quality assurance systems can be summed up in that it gives the ability to produce a product identical with the required requirements, as well as to save production costs by reducing waste and faulty goods. Projects in particular have a significant influence since they are time-sensitive and may be the project's primary motivator.

For instance, whatever transpires on any given day of the project's overall duration will result in a sizable profit for the owner. For oil developments, the same holds true. As a result, while decreasing or not rejecting any product, time is saved by not having to undo or fix what has already been done, or by not having to engage in negotiations between the contractor's team and the owner's and supervisory staff. By lowering the quantity of customer complaints, a high-quality product helps to establish a strong and positive relationship between the seller and the client. However, a procedure that consistently results in complaints from the contractor is likely to have issues with QA maintenance, and a subpar QA system may limit access to many domestic and international markets [5]–[8].

DISCUSSION

Construction projects must adhere to the necessary standards, requirements, and client expectations, hence quality assurance is essential to the sector. The term quality assurance refers to a variety of procedures and practices used to monitor, manage, and enhance the caliber of building projects. With multiple players, elaborate designs, and complex building procedures, the construction sector is renowned for its complexity and interdisciplinary nature. Therefore, ensuring the quality of building projects is crucial to ensuring the built environment's safety, functionality, and longevity.A rigorous quality planning process is the first step in implementing quality assurance in construction. This entails creating a thorough quality management system, establishing quality standards, and setting quality targets. To

provide the foundation for reaching the intended level of quality, quality planning takes into account elements including project needs, relevant laws, and industry best practices[9]–[12].

Following the start of the construction project, quality control measures are put in place to monitor and confirm that the deliverables and construction activities adhere to the set quality standards. In order to make sure that the materials, workmanship, and procedures adhere to the necessary requirements, quality control requires routine inspections, testing, and documentation. Any deviations or non-conformances are found, recorded, and dealt with using the proper remedial measures. Continuous quality improvement, in addition to quality control, is a crucial component of quality assurance in construction. To improve construction processes and results, this entails analyzing quality data, spotting patterns, and putting corrective and preventative measures in place. Continuous improvement initiatives are aided by the implementation of best practices, stakeholder input, and lessons learnt from past projects. The cooperation and dedication of all project participants, including customers, contractors, subcontractors, suppliers, and regulatory agencies, are necessary to achieve quality assurance in construction.

Everyone is in alignment with the project's quality goals and actively contributes to maintaining and enhancing quality throughout the project lifecycle thanks to clear communication, shared accountability, and frequent meetings.Additionally, the method quality assurance is carried out in construction has changed as a result of the use of technology and digital tools. More efficient and effective quality data collecting, analysis, and decision-making are made possible by cutting-edge software, mobile apps, data analytics, and real-time monitoring systems. This enables prompt interventions, greater communication, and higher-quality performance all around. In order to guarantee that construction projects satisfy the necessary standards and client expectations, quality assurance is of the highest significance in the construction business. Construction companies may offer projects that are secure, long-lasting, and of a high caliber by using efficient quality planning, control, and continual improvement. Collaboration between stakeholders and the use of technology both help building projects produce high-quality results.

Quality Assurance in the ISO

When there is a contract between the parties and the manufacturer, ISO 9001 outlines the specifications for quality management systems and lays out a framework for quality assurance throughout the product's development, design, manufacturing, and usage.

The Responsibility of the Manufacturer

A manufacturer is defined as a person who manufactures or supplies a product, as well as a person who provides any necessary service, and under a TQM regime, the manufacturer bears primary responsibility for upholding quality requirements. A reputation for respecting and satisfying the requirements of a TQM system has itself evolved as a significant competitive advantage in the globalized marketplace of modern international trade. This may be observed in the abundance of offices, global consulting firms, or multinational contracting firms vying for various types of building contracts throughout the Arab world, mostly based on how comprehensive and dependable their quality assurance systems are. Serious competitors at this level should follow two essential stages. The upper management level must first exhibit it’s When it comes to taking the initiative in projects, QC and QA have a sincere enthusiasm in doing so. Second, the management level maintains a climate that makes it simple to deal with QA regulations and guarantees that all workers follow the necessary guidelines and QA procedures. At the administrative level, such a promise is typically seen negatively as a restriction on the freedom of action seen required to fulfil contract duties as quickly and

effectively as possible. Senior management should pay special attention to the training process to prevent this, planning training sessions on quality assurance practises and technical labour in particular for all company personnel.

Responsibility of the Owner

Where should the ultimate blame for a project's failure be assigned? The owner who started the project and put together the funding for its completion must bear responsibility for this. The owner or owner's representative must ultimately bear responsibility for any issues with a project's quality goals not being met, including issues such as subpar final products or the project's failure to comply with various required specifications, as they were not adequately or effectively communicated to those responsible for carrying out the project. Therefore, the TQM strategy requires that the contractor collect and preserve all data necessary for the project's execution, and that the owner's consultants' office is responsible for making sure the contractor is so outfitted. The interaction between the owner, the contractor, and the consultant or engineer is shown in Figure. 1. Its lines of information exchange traffic highlight the key complexities of such a triangle interaction while also demonstrating how any QA/QC failure on the part of one party has an impact on the other parties.

The contractor or manufacturer decides the price and timeline depending on the requirements and the quality of the finished product. But in order for them to be successful on this front, the owner must first determine what the project's essential requirements are. One of the owner's most significant and vital obligations is choosing the contractor sometimes known as the manufacturer. or the owner's agents. The owner chooses the engineering office first. When execution begins, the owner mustChoose the builder. As a result, it is the owner's or the owner's representatives' duty to learn enough about the contractor's and engineering office's prior professional experience to determine if they have handled projects comparable to the one at hand. The owner is uniquely situated in this triangular relationship to keep an eye on the full and actual financial situation of the project and ensure that the other two partner-groups are able to fulfil their obligations to the delivery of the project, which serves to reinforce this responsibility.

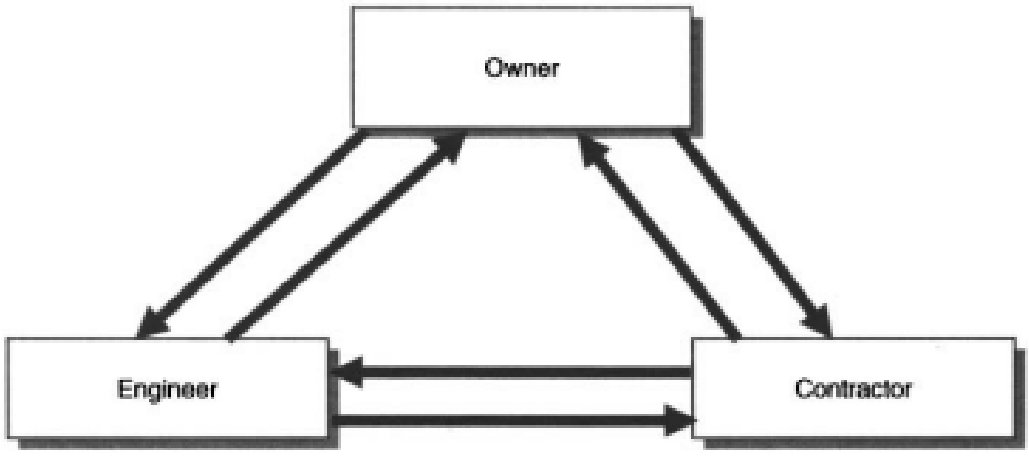

Figure 1: Relation between owner, contractor, and engineering company [Access Engineering Library].

Project Quality Control in Various Stages

A project is defined as a set of activities with a beginning and an end in the broadest sense that this book has been written around. The complexity and scale of industrial construction

projects are frequently used in this book as the basis for the majority of its key examples because they stand in direct proportion to one another. This situation also serves to simplify the author's educational task while simultaneously easing the reader's learning burden. There are social or cultural initiatives, such constructing an opera house, theatre, library, or another structure. Buildings for homes or businesses are being constructed as part of the housing project. Roads, bridges, and other civil building projects, among others, Railway. Although irrigation projects exist, this book focuses on industrial building projects, especially for oil and gas operations. This is true once again given that the current chapter's emphasis is on QA, QC, and TQM.

The specifics of how these concepts might apply to software design projects or literacy training projects, for example, may not be as well-defined as ISO standards for large capital projects with some type of construction component, but the justifications for taking the most deliberate approach to establishing quality expectations for such projects and observing how they are to be fulfilled would involve the same issues of fundamental principle.

According to the size and cost of the project, building industrial projects will differ from one to the next. However, it's important to remember that the amount of quality control must inevitably vary depending on the scope of the project. Today, this is glaringly obvious in the case of building projects carried out in many developing nations. Small businesses may have adequate quality control measures in place, but contracting firms or independent engineering firms that compete internationally are also raising the bar on their projects' quality. Of course, this inevitably drives up the overall cost of these projects. The answer to solving this problem lies in what and where? The key is to identify quality concerns at the phase or stage level of a project's life cycle and to maintain project management throughout each of those phases. The conversation will now concentrate on the quality control concerns that emerge throughout the different project lifecycle phases.

Feasibility Study Stage

Each stage has its own significance and an influence on the project as a whole depending on the type, conditions, value, and goal of the project. The feasibility study phase, which is followed by preliminary investigations, establishes the aim and allows for the choice of the guiding principles and future engineering.

The feasibility stage establishes the objective as well as the economic viability of any chosen movement. Full discussions and analysis are hallmarks of a complete feasibility study carried out by an experienced and qualified company. Consideration of all relevant economic facts with the goal of thoroughly recognising and excluding all potential outcomespotential surprises.

The goal of hiring a competent consultant to conduct a feasibility study is to allow the formation of a more complete and grounded understanding of what the owner or ownership group may realistically anticipate. Following this, a strategic choice must be made on whether to go forward with the project and, if so, when and how.

The choice of the organisation that will perform the feasibility study by the owner or ownership group is crucial in the case of relatively large-scale projects, and within this the most important element is the consultancy's track record and experience with such projects. In today's global economy, it often turns out that the finest skill set will be located abroad, someplace other than the owner's or ownership group's nation of origin.

Quality Considerations during FEED (Front-End Engineering and Design) Preliminaries

Front-end engineering and design (FEED)'s second phase starts once the project's feasibility research is finished, along with goal-setting and strategic decision-making. This stage of technical studies provides the most probable geometry of how the project may really progress, which is no less significant than the feasibility-study stage. The success of the project moving forward will rely on both the details of the engineering how-to generated during this stage of technical research as well as the project's overall conceptual viability. The owner should make a significant effort to pick and choose the consulting firm's skills and experience with this specific kind and scope of project. The experience of engineering projects varies based on the kind of industrial project, whether it belongs to the petrochemical industries, oil and gas plants, power stations, or other industrial projects. This is one of the most crucial factors.

For instance, the construction gender of the building needed in minor projects like constructing flats, offices, or a small factory will be more completely established in this phase. Beginning engineering research. Will precast, pre-stressed, or reinforced concrete be needed? The response to this query specifies the necessary building materials, such as the kinds of columns, beams, frames, shear walls, solid slabs, flat slabs, hollow blocks, etc. The choice and quantity of each of these options will depend on the size of the structure itself and the owner's needs.

The difficulty of this phase rises when large-scale projects like stadiums or oil and gas projects are involved since these studies connect with spatial concepts. This might include important issues like a land surface's ability to sustain different types of load-bearing buildings based on the soil type. This will then dictate the kind of foundation that has to be developed and the depth at which it should be buried. These kinds of factors are taken into account when planning oil and gas projects, and they have an impact on how pipes are installed and/or other types of surface transportation are carried out onsite.

The interaction between the many civil, mechanical, electrical, and chemical engineering disciplines throughout the project's development is yet another factor that these studies must establish.

In order to clearly specify the project's needs in the Statement of Requirement (SOR), engineering studies are a crucial input in the process. That document is essential for the quality assurance system since it includes all of the owner's information.

The SOR should be employed when making certain structural alterations in addition to being necessary for new or large-scale projects. In the case of a residential structure, the owner should decide on the necessary number of storeys, the number of apartments to be located on each level, the number of stores to be included, and any other necessary needs. The engineering office delivers their engineering analysis in a Basis of Design document (BOD), guided by the requirements in the SOR.

The Engineering Consulting office explains the important regulations and requirements for the design, the mathematical formulae to be utilised, any computer software that will be used, the necessary number of copies of the drawings, and the sizes of the drawings. Other data, such as land or marine meteorological data and physical survey data, may also be included in the BOD when appropriate. The owner and the engineering office evaluate the BOD together, and each updated and revised version of the BOD that results from additional examination is documented.

Regarding the procedures followed in handling drawings and updating them, care must be taken. Any created designs should be provided to the FEED team so they may be examined and implemented. The designs are returned to the owner's engineering office when the predetermined amount of time has passed, as agreed upon in advance. Until the engineering studies are finished, comments are returned to the owner. Large projects may take months to complete this phase, which puts a premium on cost management and increases the burden on the engineers in charge of keeping a running but increasingly precise estimate of project costs moving forward. Given that exploratory investigations are being finished and the project schedule is being finalised to meet what the engineering studies have found, the aim in cost management at this stage is the refining of the project cost estimate to as precise a level as feasible. Another significant area of future expenses on which to start getting a hold is the continuous cost of project maintenance. At this same stage, before actual building starts, and given what the engineering study helps to reveal about the methods and means presently accessible to continue, this is an essential area of future costs.

The first step in doing this is establishing the project lifespan, taking note of the building guidelines followed, the kind of structure, and the maintenance strategy. In order to lower the long-term maintenance costs, the project site and the surroundings around it must be weatherproofed.There are several different types of protection systems, and each one affects the project outlay curve differently. For instance, using stainless steel involves significant upfront expenses, followed by routine maintenance that adds just a little amount more. As an alternative, there are defence systems with modest initial capital costs whose upkeep over time will raise the sum that must be budgeted each year for inspections and any maintenance that is necessary as a consequence of those inspections.

The engineering studies should consider a number of the structure's characteristics related to its location and the ease or complexity of maintenance work that results from that. Similar considerations must be made when choosing mechanical equipment at first: whether to choose project units with the highest reliability and consequently low maintenance costs but a high initial capital outlay, or whether to choose equipment with lower reliability ratings and potentially higher future maintenance costs but a lower initial cost. Engineering studies are required to provide the same option in each rubric: high initial expenses followed by predicted low continuing maintenance costs, or less expensive expedients with uncertain and perhaps rising maintenance costs in the future. For instance, a water tank in the building of a power plant is showing signs of dependability problems. During the course of the plant's operation, would it need maintenance or cleaning? Choosing whether or not a second tank is required is the solution to this issue. Alternative design concepts may be used if this one is not required. These kind of judgement calls place a specific burden on the expertise of the engineers and contractors engaged. Any mistake might lead to complications down the road that would seriously harm the project's chances of success, as opposed to starting again with a simpler solution that costs less and works just as well.

CONCLUSION

Construction projects must fulfil all necessary standards, requirements, and client expectations, hence quality assurance is a crucial component of the sector. Construction companies may offer projects that are secure, long-lasting, and of a high caliber by using efficient quality planning, control, and continual improvement. An extensive quality management system is created as part of detailed quality planning, which also establishes goals and criteria for quality assurance throughout construction. Through the project lifetime, this lays the groundwork for reaching the target level of quality.

The next step is to adopt quality control measures to ensure that all construction-related activities and outputs adhere to the predetermined standards. The necessary standards are met by materials, craftsmanship, and procedures thanks to routine inspections, testing, and documentation. Any discrepancies are handled by taking the necessary remedial measures. An additional essential component of quality assurance in construction is continuous quality improvement. Construction Organisations may improve their processes and results by doing quality data analysis, spotting patterns, and putting corrective and preventative actions in place. The use of best practices, lessons gained, and input from stakeholders all contribute to continual improvement initiatives.

To successfully implement quality assurance, all project stakeholders must work together and be committed. Everyone is in alignment with the project's quality goals and actively contributes to maintaining and enhancing quality thanks to clear communication, shared accountability, and frequent meetings.Construction's quality assurance methods are now much more effective and efficient thanks to the usage of technology and digital technologies. Real-time quality data collecting, analysis, and decision-making are made possible by cutting-edge software, mobile apps, data analytics, and real-time monitoring systems. This enables prompt interventions, greater communication, and higher-quality performance all around. quality control in construction is essential to guaranteeing the functioning, longevity, and safety of building projects. Construction Organisations may produce projects that satisfy the needed standards and customer expectations by employing efficient quality planning, control, and continuous improvement procedures. Technology use and stakeholder collaboration are other factors that help construction projects provide high-quality results.

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CHAPTER 7

IMPACT OF THE PROJECT RISK MANAGEMENT

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ABSTRACT:

A key component of project management is the identification, evaluation, and control of risks that might affect the project's goals. An overview of project risk management, its significance to project success, and important steps in the risk management process. The goal of project risk management is to proactively handle any risks and uncertainties that might have an impact on project results. It entails taking a methodical approach to risk identification, evaluating the probability and effect of such risks, and creating the best possible strategy to address or mitigate them.The importance of project risk management in achieving project success is highlighted in the chapter. Project managers may make wise judgements, efficiently allocate resources, and reduce the possibility and impact of undesirable occurrences by recognizing and managing risks early on. The description describes the main steps in the risk management process, such as risk identification, risk assessment, planning for risk responses, and risk monitoring and control. Through the course of the project lifecycle, these processes allow project teams to methodically assess and deal with risks. The value of stakeholder involvement in project risk management. It is possible to have a thorough awareness of risks, agreement on risk response plans, and shared responsibility for risk management via effective communication and cooperation among project stakeholders.The relevance of technology and tools in project risk management is also highlighted in the chapter. The accuracy and effectiveness of risk assessment and decision-making processes may be improved through the use of risk management software, data analytics, and simulation approaches.

KEYWORDS:

Assessment, Monitoring, Management, Project, Risks.

INTRODUCTION

A key component of project management, project risk management is concerned with locating, evaluating, and controlling possible risks that can affect the project's goals. Every project has some level of risk, and good risk management enables managers to anticipate problems before they arise and lessen their effects.

The first step in introducing project risk management is to comprehend the idea of risk. Any unknown situation or occurrence, such as one involving cost, scheduling, quality, or scope, that might have an impact on the project's goals is referred to as a risk. These hazards may result from a number of things, such as technological difficulties, environmental considerations, organizational limitations, or outside pressures. The main objective of project risk management is to increase possibilities for successful outcomes while minimizing the possibility and severity of possible hazards. Project teams may identify, analyze, assess, and react to risks in an organized way thanks to this methodical and iterative procedure. The significance of project risk management for attaining project success is also emphasized in

the introduction. Project managers may make wise judgements, distribute resources wisely, and guarantee that projects are completed within the established parameters by proactively managing risks. It aids in preventing or lessening expensive delays, budget overruns, quality problems, and other unfavorable outcomes[1]–[3].

Risk identification, risk assessment, risk response planning, and risk monitoring and control are only a few of the essential elements of project risk management that are highlighted in the introduction. These elements provide a structure for methodically controlling risks over the course of a project. Risk assessment analyses the possibility and effect of recognized hazards whereas risk identification identifies prospective risks and their characteristics. Creating solutions to manage risks, such as avoiding, minimizing, transferring, or accepting them, is the main goal of risk response planning. Last but not least, risk monitoring and control include ongoing risk monitoring, the implementation of risk response strategies, and necessary change adaptation. The need of stakeholder participation in project risk management is also emphasized in the introduction. By including them, you may get new insights, benefit from their knowledge, and better match risk management tactics with project goals. Additionally, it encourages openness, dialogue, and shared accountability for successfully managing risks. Project teams can proactively handle possible risks and uncertainties thanks to the crucial process of project risk management[4]–[7].

Project managers may successfully manage risks, maximize project outputs, and raise the likelihood of project success by using a methodical approach and incorporating stakeholders. The many elements of project risk management will be covered in further depth in the following sections.Project risk management includes not just detecting and resolving risks, but also prioritizing risks based on their potential effect and propensity to occur. This enables project teams to concentrate their time and resources on controlling the most important risks that might materially influence project goals. The systematic evaluation of and reaction to recognized risks is aided by risk management approaches and tools including risk registers, probability-impact matrices, and risk mitigation strategies. These methods provide an organized method for identifying risks, evaluating their possible effects, and creating effective mitigation or control solutions.

Furthermore, during the course of the project lifecycle, project risk management should be regularly evaluated and analyzed since it is an iterative process. As the project moves on, new risks can appear, current risks might change, and it might be necessary to reevaluate and revise the efficacy of risk response techniques appropriately. Project team members, stakeholders, and other relevant parties must work effectively together to communicate and collaborate if project risk management is to be successful. Sharing risk information is facilitated by open, transparent lines of communication, which also ensure that everyone is aware of possible risks and their individual roles and responsibilities in managing them. Project resilience is raised, project performance is improved, and project risk management practices are ultimately implemented. Project managers may traverse uncertainties, adjust to changing conditions, and maximize the chance of project success by successfully recognizing, analyzing, and managing risks[3], [8]–[10].

DISCUSSION

The perspective of a project proposal's total economic possibilities, both favorable and unfavorable. The definition, management, and mitigation of risks that arise during project execution are covered in this chapter. The probability studies and Monte-Carlo simulation methods are crucial in this evaluation, which is known as quantitative risk assessment, when looking at risk assessment for a project from an economic perspective. However, this

approach to research and evaluation needs specialized tools and knowledge. Using qualitative risk assessment techniques, as we shall outline in this chapter, to apply risk assessment in the execution phase. No specialized knowledge or software is needed for this testing approach. A team participating in the project's execution, normally under the direction of someone with expertise in qualitative risk assessment methodologies from prior comparable projects, will typically use a mix of experience and qualitative skills to manage risk throughout the project's execution. Poor, sloppy, or otherwise insufficient execution of a programmed task(s) whose remedy would increase project costs, time, or overall output quality, is one of the biggest sources of risk to be controlled. The project's potential for risk is lower now than it was at the beginning. The dangers may be divided into two groups.

1. Project risks are the risks that can happen during a project due to technical mistakes that can occur during construction.
2. Process risks are the risks that can occur during the project due to procedural mistakes, poor communication between the project team, and poor team performance.

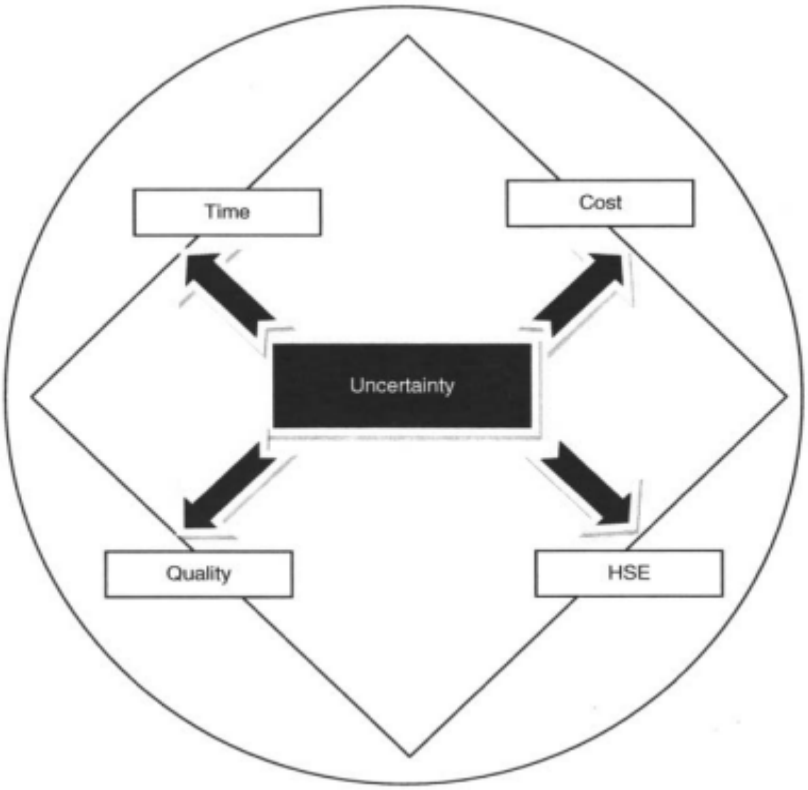

Figure 1: Represting the Sources of uncertainty [Access Engineering Library].

In general, there are several sources of uncertainty, particularly in the key project components of cost, time, quality, and HSE, as shown in Figure 1. Our goal is to reduce these uncertainties, make educated guesses about what could occur, and take reasonable steps to prevent it. Figure 1 illustrates how the level of uncertainty is comparable to a black box, where no one can predict what will happen. Uncertainties are things that may happen, while objectives are things that must occur.

The Risk Management Process

The systems approach to risk management described in the Guide to the PMBOK is used by the Project Management Institute (PMI). There are six main steps that make up the risk process.

1. Risk management planning.
2. Risk identification.
3. Risk assessment.
4. Risk quantification.
5. Risk response planning.
6. Risk monitoring and control.

Project Risks

The possible danger will become clearer after the timetable is finished. The project manager's understanding of potential risks is crucial since he is responsible for recognizing the activities that will have a greater risk of negatively impacting the overall project execution and lengthening its duration or both. Costs will rise In light of the following information, the project manager should analyze the planning schedule and identify areas of planning that have significant risks.

1. Tasks on the critical path.
2. Tasks that need a long time period in which to be executed.
3. Tasks that have a little overtime.
4. Activities that start with the beginning of other activities.
5. Tasks that need many individuals for their execution
6. Complex tasks.
7. Activities and tasks that need condensed training.
8. Tasks that need new advanced technology.

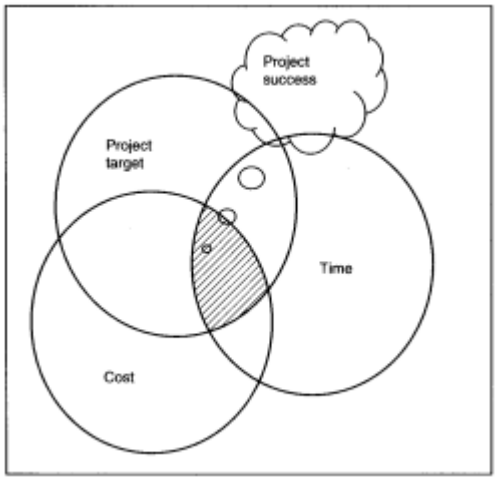

Figure 2: Represting the Point of project success[AccessEngineeringLibrary].

The steps required to implement those tasks, how to monitor implementation on a daily basis, and who should be responsible for follow-up at that stage of the project must be identified and planned after choosing the tasks that would pose risk to the project and determining their position relative to other risks and tasks. The example of pouring concrete is informative in better illuminating what kinds of things might be regarded as high-risk operations during project execution. Excavation work is one of the project's riskiest activities. It is on the project's critical path and requires a lengthy amount of time to complete. As a result, there is a great likelihood that it will be delayed, which might have a significant effect on the whole project. The riskiest activity in each project is the one that is longest and placed on the critical route. On the other hand, there is a known and hence more manageable danger of experiencing delays with the delivery of machinery and other mechanical equipment bought from overseas.

By scheduling jobs that can be completed without the equipment to begin or conclude prior to arrival of the equipment, the effects of such a delay may be partially reduced. Depending on how many other operations rely on the arrival of the anticipated equipment, the difficulty of such job rescheduling will vary. Excavation and waiting for the arrival of required equipment are two instances that both have high risk ratings since they are beyond the scope of project management. The accomplishment of the project's goals within the allocated spending limit and time frame constitutes its success. However, over the course of the project's execution, some expenses, the length of time, and the project's goals may change. According to Figure. 2, the success of the project is truly determined by how well these three components interact with one another. The likelihood of success is low, according to the preceding discussion of probability. The project will be put in the area of mutual junction.The project has a lot of non-specific regions that might introduce problems. Any of the following may be one of these.

1. Activities of a long period of time and on the critical path.
2. A lack of identification of the project objectives.
3. A non-competent project manager.
4. An inaccurate cost estimates.
5. A bad atmosphere, in general, in the project.
6. Achieving customer satisfaction.
7. A rapid change in resources during time periods.

The allocation of personnel and other resources onsite throughout a building phase is shown in Figure. 3. The project's initial resources and operations are scarce. There is a transitional area when resources rise as a result of rising activity. In this change

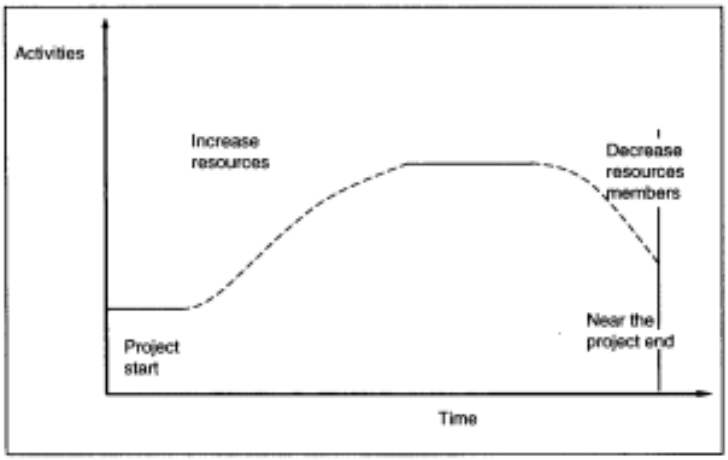

Figure 3: Represting the Change in staff volume during a project[AccessEngineeringLibrary].

Zone will be high risk since it will quickly expand the number of workers on the project within a short period of time. Therefore, there will be a very high probability of poor quality, misinterpretation of the goal, and errors in safety practice. Since the amount of resources will be stable in the middle of the project, the risk will be lower. After that, begin the second transition zone by cutting back on resources. This stage carries a high risk because there is a chance that you'll run out of staff quickly and may forget to hand over or transfer equipment that you might need in the future. At the same time, as staff is being cut back, everyone working on the project will be busy looking for other opportunities on other projects. You may use the list below as a checklist to help you identify the risks associated with uncertainty in your project. The following list summaries the typical causes of uncertainty in projects:

1. Scope of work.
2. Quality of estimates.
3. False assumptions.
4. Technological novelty.
5. Changes in technical specs.

Risk Assessment

In Figure. 4, the risk assessment process is shown. The first phase is to specify the anticipated risks associated with project execution, followed by an analysis of those risks. Setting a priority for these risks is the last stage. No matter what the endeavor is, there is always a risk involved. Priorities for developing solutions and mitigating risks may be established by concentrating on the risks impacting the management of the project. The following inquiries must be answered truthfully and objectively in order to evaluate these risks:

1. What is the risk exactly?
2. How do these risks affect the project?
3. What can be done to reduce the impact of the risks?

At this point, the risks will be evaluated based on how they will affect the goals, timeline, and cost. We now need a simple technique for evaluating the hazards realistically, and this approach is known as qualitative risk assessment.

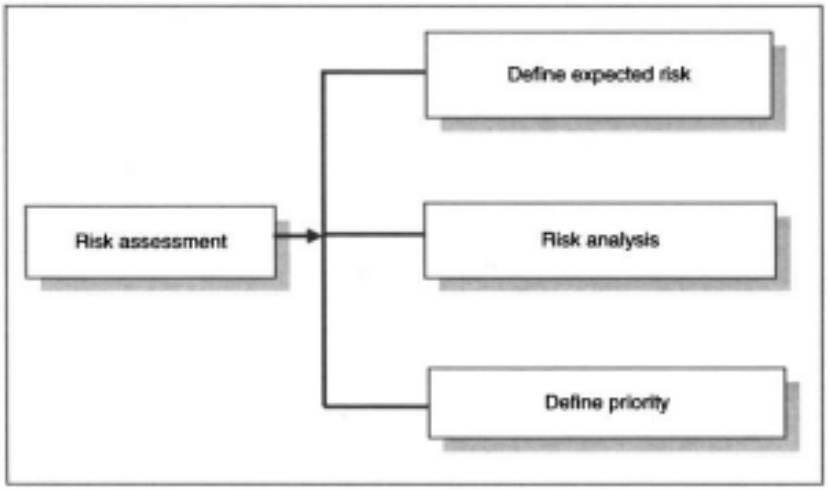

Figure 4: Represting the Risk assessment tools [AccessEngineeringLibrary].

Grouping of Risks

The risks need to be categorized after describing the whole range of events that might happen during project execution, impact the project aim, or extend the project's duration or cost. Utilizing quantitative methodologies, risk-related regions are ranked, and the project's crucial stage is determined using fairly objective standards. Then, all project participants are gathered for a brainstorming session with the goal of reaching an agreement on which risks are most likely to occur within particular time frames and their potential impact on the project's cost and completion deadlines. It will be more crucial for big initiatives than for small ones to group risks. In the business world, it is often believed that a meeting to discuss a group of risks requires more than 10 participants, it is definitely too big and will not be effective. A succession of risk management meetings is required as projects get bigger, although one meeting may suffice for a small project. Techniques like to those used in the

creation of the work breakdown structure may be utilized to make this easier. Indeed, meetings for risk management may be planned using the WBS itself.

The person who is most directly connected to the area where the risk will have the most effect, or the person who is most knowledgeable with the risk's technology, should be given the responsibility of looking for risk. The person in charge of a job should be concerned about any risks that arise while it is being completed and that only directly impact that activity. The assignment of responsibility, however, travels up the organizational ladder to the person above the person directly or immediately accountable for the work since no task in a project is completely independent of all the others. The project manager often establishes the job of risk manager in projects where risk is a major issue. This individual is in charge of keeping track of all hazards and updating the risk management strategy. This strategy becomes increasingly important when projects grow in size or as risk tolerance decreases.

Risk Monitoring and Control

The process of risk monitoring and control include keeping track of all the risks that have been recognised, as well as recognising new risks as they emerge and residual hazards that arise from the application of risk management strategies to specific risks. Throughout the project, the effectiveness of the risk management strategy is continually assessed. The processes for risk monitoring and management are shown in Figure. 5. After determining the importance of each risk, you should work with the project team to find a solution. Next, decide on an emergency plan, and then specify the monitoring system that you will use as the project manager for each risk.

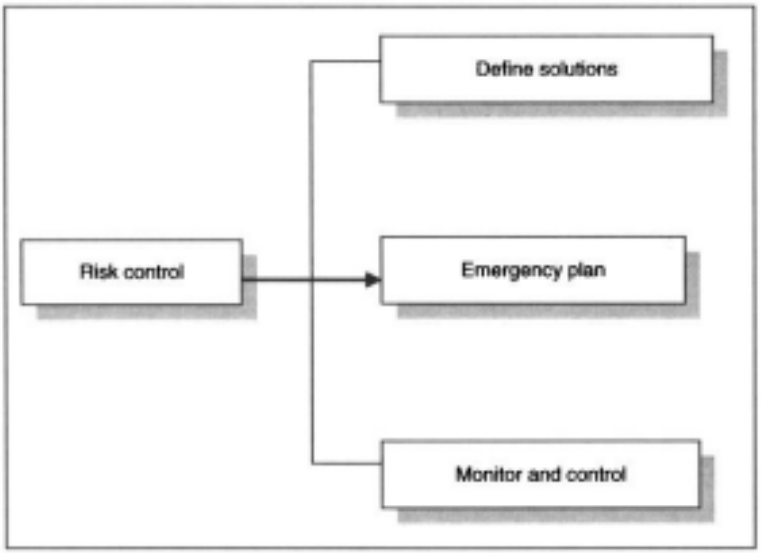

Figure 5: Represting the Steps in controlling the risks[AccessEngineeringLibrary].

A backup plan is implemented when a danger seems likely to materialize. In the absence of a contingency plan, the risk is managed haphazardly via the use of a workaround. An impromptu reaction to a bad risk occurrence is a workaround.

The implementation of the workaround or contingency plan constitutes a remedial action. The project manager and the project team are worried about whether risk responses have been applied to the risk as intended and if they have been successful. Additional risks might arise or further actions could be required after they have seen how well the risk response has worked. From the beginning to the finish of a project, risk management is a continual activity. The identified risks are monitored as the project moves forward and are updated when the

window of opportunity closes. Monitoring early warning signs allows us to reevaluate the risk's effect and likelihood. The risk tactics are evaluated for suitability as the danger draws near, and new responses are developed. Risk evaluations, reviews, and audits might be carried out. to examine the likelihood and potential effects of risks that have been identified and are getting closer to becoming likely occurrences on a regular basis. Once risks have already occurred, they may be examined and audited to see if the risk response is working. These modifications must be recorded when each danger manifests itself and is addressed or avoided.

This sort of risk will be managed more effectively going forward thanks to good documentation, and the next project manager will benefit from these lessons learnt.

CONCLUSION

By proactively detecting, evaluating, and managing possible risks, the discipline of project risk management is essential for ensuring the effective completion of projects. It is essential for reducing the chance and effect of uncertainties that could obstruct project goals and results. Project managers may efficiently negotiate the complexity of project settings and make wise judgements by using a systematic and iterative approach to risk management. Project teams may reduce possible risks, take advantage of opportunities, and maximize project performance via risk identification, assessment, reaction planning, and monitoring.It is impossible to emphasize the value of stakeholder participation and involvement in project risk management. A shared feeling of responsibility is fostered, effective risk response plans are made possible, and the identification and understanding of risks are improved by including stakeholders from different levels and disciplines.

Project risk management also includes a considerable contribution from technology and tools. More accurate risk assessments, scenario planning, and decision-making are made possible by risk management software, data analytics, and simulation approaches. These developments increase the speed and precision of risk management procedures. Continuous monitoring and assessment are necessary for effective project risk management. As the project moves forward, risks might change or new ones could emerge.

The project is kept robust and flexible to changing conditions by regular analyses and revisions of risk response measures. Project management must include the management of project risks. Project teams may improve project results, reduce possible interruptions, and raise the chance of project success by proactively identifying, analyzing, and managing risks. Project risk management becomes an inherent component of project execution via effective stakeholder participation, the use of technology, and ongoing monitoring, allowing projects to accomplish their targeted goals.

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CHAPTER 8

PROJECT CLOSE OUT: LAST STEP OF PROJECT CYCLE

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ABSTRACT:

Project closeout, the last stage of the project lifecycle, is concluding all project-related tasks, assessing the success of the project, and handing over deliverables to the client or end-user. An overview of project closeout, including its significance and important steps, is providedcritically important, project closeout marks the end of the project's goals and the start of the operational phase. It includes a range of tasks including wrapping up paperwork, doing project reviews, getting project approvals, and making sure deliverables are handed off without a hitch emphasizes how crucial project closeout is to project success. It enables project teams to evaluate a project's effectiveness, note any lessons discovered, and record best practises for subsequent initiatives. Additionally, it offers a chance to assess project results in relation to the established goals and confirm that all contractual and legal requirements have been met.A final project review to assess project performance, resolving any outstanding issues or defects, archiving project documentation for future use, and facilitating the delivery of project deliverables to the client or end-user are key activities in the project closeout process. Stakeholder participation and effective communication are essential throughout project closeout. It makes ensuring that all stakeholders are aware of the project's end, that any unresolved issues are taken care of, and that the relevant handover procedures are successfully accomplished.

KEYWORDS:

Closeout, Contractor, Life cycle, Phase, Work.

INTRODUCTION

The project lifecycle's last phase, project closeout, signals the conclusion of project execution and the start of the operational phase. It includes a number of procedures and activities meant to complete project deliverables, assess project effectiveness, and guarantee a seamless handover to the operational team or end-users. For the project to be officially finished, all contractual responsibilities to be met, and lessons learnt to be applied to future projects, it is essential to complete the closeout phase. Project teams concentrate on finishing all outstanding tasks, resolving any difficulties, and completing all required paperwork and documentation during project closeout. This stage offers the chance to consider the project's accomplishments, evaluate how well it accomplished its goals, and pinpoint opportunities for development. Effective communication with stakeholders, such as customers, sponsors, team members, and the appropriate authorities, is another aspect of closeout. The closeout procedure varies according to the project's scope and complexity as well as any particular contractual obligations. However, it often entails responsibilities like performing evaluations of completed projects, resolving concerns, finishing off administrative and financial work, preserving project records, and promoting knowledge sharing[1]–[3].

The significance of this phase will be highlighted, and this article will provide insights into best practices for a successful and thorough project closure. It will examine the important actions and factors involved in project closeout. Organisations may guarantee a seamless transition to the operational phase, record important lessons learned, and improve future project performance by adhering to efficient project closeout practices. In big industrial plant projects, construction is inspected continuously; nevertheless, the owner's representative often demands vessel inspection before closure and significant equipment testing after installation. The stage of project development when these operations are carried out is sometimes referred to as mechanical completion. Because it might be difficult to define mechanical completeness, the project manager should create a standard for plant completion with the owner's representative to make sure everyone is on the same page[4]–[6].

This has to be included in the construction contract so that everyone participating in the project is aware of who is responsible for what throughout each stage of the project. The contact between the owner's representative, the principal designers, and the contractor must be coordinated by the project manager in collaboration with the construction contractor. Each party's obligations must be spelt out in detail. Additionally, in line with the contract papers, it is necessary to specify the testing process and test kinds in detail. For establishing when a vessel may be closed, the lead time notice needed for inspection, what is to be monitored, and a sign-off sheet for the owner's representative, a written plan should be created. This is vital to prevent pointless vessel opening and shutting, which may take a long time to complete. The process for handing over equipment to the owner must be confirmed in writing by the project manager from the owner's representative[7]–[9].

Due of the high expenditures involved, care and custody are crucial. Each side has to be aware of who is accountable and when they are accountable. When a piece of equipment is finished, tested, and ready for use, the project manager must inform the plant. Able to be turned over to the owner. Any further changes after acceptance need the owner's work authorization. The way this process is handled should be official. With the appropriate representatives' signatures being necessary. To define the start-up process, the project manager must work in tandem with the contractor and designer. Although formal, the procedure must be adaptable. The project manager should get a written statement from the owner's representative outlining the assistance that each member of the project team will need during startup. The owner must be involved in the project, and the project manager must avoid assuming they have certain demands[10], [11].

DISCUSSION

Throughout the course of a project, construction activity is inspected. Numerous pieces of machinery, electrical systems, and mechanical systems could be finished before the whole project is finished and prepared for testing and approval in accordance with the contract requirements. The owner's representative and the designers who are in charge of inspection, testing, and final acceptance must collaborate closely with the project manager. The building contractor should get a formal notification that provides a definition of mechanical completion and provide enough advance time for the process. This is essential to avoid losing a significant amount of time that might harm the project's deadline. The owner must have a clear concept of the tests they want to watch, the things they want to check throughout the tests, and the kinds of testing that are necessary. The owner, designer, and contractor are the three main contractual parties, and their roles must all be specified. The project manager has a responsibility to efficiently organize this activity. When the contractor asks a last examination of the work towards the conclusion of a project, project close out officially starts.

A punch list with all tasks still needing completion or correction is created prior to the request. The field inspection staff must carefully go over their daily inspector's record to identify any work items that have been submitted that need to be corrected before creating this punch list. Before the work is sufficient for acceptance, the punch list procedure may need to be repeated numerous times. Representatives of the owner, contractor, and the principal designers the architect, as well as the civil, electrical, and mechanical engineers, etc. who worked on the project, should attend the final walk-through inspection. The acceptance of the work and the final payment to the contractor shall be made in accordance with the provisions of the contract agreements, and the project manager shall plan and perform the final walk-through inspection. When construction is sufficiently finished in line with the contract agreements so that the project may be utilised for its intended objectives, it has reached its substantial completion.

This indicates that there are just a few minor tasks left to accomplish and that the project is ready for usage. A list of all the tasks still needed to be done to finish the project may be added to the contractor's Certificate of Substantial Completion. The work has been accepted as complete when the Certificate of Substantial Completion and the related defect list are approved. Since the contractor has no further obligations under the contract once the owner signs the certificate, it is crucial to make sure the list is exhaustive. Following the satisfaction of all defects, ultimate payment, together with the release of all retainage, is often delayed for thirty to forty days. The contractor must provide all necessary papers, including warranties, lien releases, and other contract requirements, before receiving final payment.

Guarantee and Warranties

Typically, the contract calls for the contractor to provide a one-year warranty once construction is finished that all materials, tools, and labor will be of high quality and faultless in line with the contract conditions. The total project's guarantee may be extended beyond the customary one-year time frame, although this is uncommon. Depending on the equipment, warranties may last anywhere between one- and five-years following installation. The owner must be given operating instructions, manuals, replacement parts, and warranty certificates. Before final payment to the contractor, the project manager must make sure that all warranties are collated and given to the owner.

Lien Releases

The property may be subject to liens filed by material suppliers, subcontractors, or employees who provided supplies, equipment, or labor on a project but have not yet received payment. Even when the owner has given the general contractor the entire amount of the contract, the underpaid party has the right to claim a lien. Consequently, if the general contractor doesn't pay its subcontractors, suppliers of materials, or personnel, the owner could have to pay for portion of the contract twice. The owner has the right to withhold payments known as retainage from the general contractor during construction in order to pay for outstanding invoices and lender liens. Most contracts contain a language in the general conditions that requires the general contractor and all levels of subcontractors to provide a lien release for all labor and materials for which a lien might be filed, or a bond that is acceptable to the owner and protects the owner against any liens. Before approving final payment to the contractor, the project manager must confirm receipt of all lien releases or the bond.

Record and As-Built Drawings

For every project, revisions and adjustments to the initial designs are nearly a given. The original contract materials that were distributed for bid purposes must be preserved in

reproducible form, at least one set. This is required for the settlement of claims and disagreements since it is certain that the question What did the contractor bid on? will come up. Additionally, there must be thorough records of everything changes in building orders. A typical clause in a contract is that the contractor must create an as-built a copy of all the shop drawings, addenda, change orders, and specifications. The size and features of the work that were not completed precisely as they were initially indicated are represented in the as-built drawings. Examples include relocating doors, moving electrical or air conditioning ducts, or locating subsurface utilities, pipes, and other concealed work. These papers, which are sent to the owner once the project is finished, detail all the modifications made to the original contract bid paperwork.

Disposition of Project Files

The project manager typically keeps two files during a project: a record file and a working file. Original copies of crucial documents pertaining to agreements, contracts, and other legal issues are included in the record file. The working file, which is the project manager's file used for day-to-day project management, often includes copies of papers from the record file in addition to correspondence, meeting minutes, phone logs, reports, etc. A project's records and files, as well as a substantial quantity of information related to the project, amass after completion.The majority of Organisations have a set process on how to deal with files (Table.1). The record file's information has to be organized and indexed for quick access and retrieval for future use. The record file often contains duplicate information that should not be deleted, some of which may include handwritten annotations. Although a large portion of the file's contents may be deleted, enough details need to be kept so the project manager can go back and review their work.

Table 1: Check List of Duties for Project Close Out.

Pmject close out	Owner	CM	Designer*	Contractor
1. Certificate of substantial completion	Approve	Review, approve, file	Review, approve	Originate
2. Clean-up	Observe & comment	Coordinate, enforce	Observe	Responsible
3. Punch list	Approve as required	Expedite & coordinate work	Prepare, evaluate work	Respond
4. Cali backs (after construction)	Request	Arrange & coordinate	Review & approve work	Respond

Post Project Critique

Every project should have a post-project review because there are lessons to be learnt from each project that can be used to increase the success of subsequent initiatives. Owner and important project players like lead designers and construction representatives should be present. All team members benefit from the input obtained via a constructive discussion of the issues and solutions discovered during a project when planning and carrying out subsequent ones. It is crucial that the whole conversation be conducted in a good and professional way for the meeting to produce the intended outcomes. The project's positive and negative features must both be addressed. Instead of focusing on who was at blame or caused the issue on this project, the emphasis should be on how to prevent or mitigate

difficulties on future tasks based on problems discovered on this work. Others who did not attend the post-project review should still get the minutes of the meeting so they may learn from the lessons. A project peer review, which is an impartial assessment of the design principles or management practises of a specific project, may be helpful. The requirements of the owner, designer, or any interested party may be addressed in project peer reviews. A report named has been created by the American Consulting Engineers Council (ACEC) and the American Society of Civil Engineers (ASCE).

Owner Feed-Back

After a project is finished and being used by the owner, a formal meeting with representatives from the owner's Organisations should be conducted to get feedback on how the project is doing. This is a crucial activity for assessing the quality of a finished project and the owner's happiness since the actual success of a project can only be gauged by how well the owner's Organisations uses it.

Impact on Project Partners and Stakeholders

One of the main tenets of Interred is that project outputs should be durable or leave a legacy. Many programmes contain selection criteria designed to make sure that outcomes and resultsand maybe even partnershipscontinue to matter after the initiative is over. This must be assured, at the very least, among project partner organisations and among the stakeholder groups who have been most closely involved with the project: It is doubtful that any permanent advantage would have been attained if a project's outcomes are abandoned right away and no desire in continuing to work on the topic.The process of integrating fresh concepts and methods into the standard operating procedures of the target organisations is known as mainstreamin or capitalization. Depending on the sort of result and solution, target audiences, and larger project stakeholders engaged, the activities might take several forms. It is often one of the primary goals of publicity and distribution efforts, but it goes a step farther than simple promotion by attempting to guarantee the use and implementation of the project's output.

The application procedure will undoubtedly favour projects with a solid mainstreaming approach. A lot of the success factors have been covered in earlier chapters in relation to communication, needs analysis, and stakeholder participation. A crucial aspect of project creation and management is planning for what will happen with the actual outputs when the project is over, and early actions should be taken to achieve these goals. There are four crucial inquiries to make: What outputs will the project produce that should be made available to a wider audience? · Which target groups should be informed about which outputs? What is the best way of reaching these target groups? How do we expect them to make use of these outputs?Early on in the project's existence, these concerns need to be addressed. Considering how each project partner should be affected by the project as a whole, who in each Organisations will need to support project outcomes for this to happen, and how they may be engaged most effectively, should be the beginning point. It's crucial to constantly keep in mind that individuals are more likely to embrace opinions they have had a hand in shaping.

The direct target audiences for the project should go through the same procedure. Exists a local company or interest group that can take over the results, for instance if it's a SME? Can SMEs be convinced to continue with their own finance when work is successful? This already begs the following final query: Is it sufficient for the target audience to be aware of the project output and to get some knowledge from it, or has the project created a tool that should ideally be utilised entirely by new stakeholders in the future? Instead of depending on

chance with an open final conference and a publication for wide distribution, this sort of question should guide the communication strategy in the project's final phase. It will help create a series of activities that will convey the required information to the appropriate individuals.The project's potential goods and services should also be given some consideration. There are just a few restrictions if a project partner has been taking part in a State Aid Programme that has been approved: Commercially viable products and services may be created, with the project partner using the money made from sales to carry out further development. It is not feasible to simply sell or charge for access to project outcomes, albeit there are tight restrictions for the majority of project partners. Planning will thus often be predicated on the free transfer of project outcomes to public entities who are prepared to pay for future operation and development expenditures.

This transfer of responsibility must be made public and include all background information and other documents required for a different entity to carry out the project's work. Programmed often stipulate that project developers cannot maintain any intellectual property rights over their work other than the ability to be credited as the creator.

Where there has been an investment in equipment or infrastructure, this sort of transfer is not feasible. In these circumstances, the project partner will need to set aside money for running and maintenance expenses after the project. Any income amounts paid to project partners for services or goods created during the projectproduced within five years of its conclusion must be recorded and the money reimbursed to the Programme.

Making an Impact

The second stage should be to go after policy makers and legislators if the first step is to target the immediate consumers of the project outcomes in order to make sure that they also take up and grasp the project's main challenges. In most cases, it is no longer possible to complete the project with the creation of a research report or the conclusion of a pilot; instead, it is expected that the partnership will identify other Programme participants who could benefit from what has been accomplished and make sure that information is effectively shared with them.It takes time and effort to do this. In order to allay worries about whether the project has solid solutions and can eliminate obstacles, increase performance, etc., it requires that policy goals and needs be understood and that trusted connections can be formed. Like other stakeholders, policymakers are hesitant to adopt final products if they were not directly engaged in their creation or if they cannot, at the very least, understand how clearly their own policies are represented in project proposals.

At project completion, this strategy of establishing positive relationships with key stakeholders early on should truly pay off. If responsible authorities do not take proposals into consideration, there is no sense in producing them. Finding excellent practices is useless if Organisations are not prepared to put them into practice. If no one outside the partnership ever reads the reports, there is no value in having them written.

It is necessary to come to agreements for how outputs will be delivered to stakeholders, when they will get them, and what they will do with them.If project findings are to be mainstreamed and accepted components of regional, national, and/or European policies or processes, stakeholder support is crucial. If stakeholders are approached early in the project and shown the finished products, this is very unlikely to happen. The project must give opportunities for feedback and will be expected to do so. Also keep in mind that the Programme and the national and regional representatives serving on the various Programme committees may be quite helpful in this situation and may have access to various connections.

Planning the Next Steps

Every undertaking requires a defined goal. There must be a time when it is possible to say with certainty if the project's goals have been met or will be attained. In many schemes, there is one area where standards are tightening up: The production of sustained stand-alone outputs via endless repetition of previous operations or reliance on more funds is extremely likely to be denied. If project activities are really valuable to the Programme area, they should eventually be able to secure their own financing.On the other hand, it is widely acknowledged that money from Interred and other programmers plays a significant role for many public entities. A lot of activity is organized around intricate portfolios of initiatives funded by various funds, with Interred offering fresh perspectives, information, and inspiration from across the world. This often fuels further investments or research in other, more significant initiatives, which may in turn spark a fresh set of problems that need investigation in an interred project. These synergies are advantageous because they allow for knowledge and expertise to be shared across sectors and levels of government, maximizing the use of various financing vehicles. Exploring how your results might contribute to these larger processes, what will be adopted by other efforts, and what remains as prospective new topics for Interred financing at project's conclusion is beneficial.

CONCLUSION

Project closeout, which marks the end of project activities and the start of the operational phase, is an important stage in the project lifecycle. Finalizing deliverables, assessing project performance, resolving pending problems, and providing a seamless handover to the operational team or end-users are all included in this extensive process.

The capacity to evaluate project performance, record lessons learned, execute contractual responsibilities, and allow knowledge transfer are all important aspects of project closeout. Organisations may discover strengths and flaws in a project's success via a comprehensive review, allowing ongoing improvement in subsequent initiatives.During the closeout phase, open communication with stakeholders is essential to assuring their comprehension of the project results, resolving any issues, and supporting a seamless transfer. Organisations may develop trust and long-lasting relationships with customers and stakeholders by clearly discussing project successes, problems, and lessons learnt. Administrative responsibilities including financial closeout, documenting and archiving, and concluding contractual obligations are all part of the closeout process. By completing these duties, you can make sure that all project-related financial issues are taken care of, crucial papers are safely maintained and readily available, and legal obligations are met. The conclusion of a project is a time to take stock of its progress, recognize its achievements, and pinpoint opportunities for development. Organisations may improve their project management techniques, streamline procedures, and avoid making the same errors again by collecting and recording lessons learnt. Project closeout is crucial for successfully completing projects, in general. It summarizes project accomplishments, takes care of unresolved problems, and prepares the way for a seamless transfer to the operational phase. Organisations may maximize project results, maintain customer happiness, and constantly develop their project management skills by adhering to best practices and carrying out a thorough closeout process.

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CHAPTER 9

PERSONAL MANAGEMENT SKILLS: KEY OF SUCCESSFUL PROJECT

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ABSTRACT:

A person's ability to successfully manage oneself and their job is referred to as having personal management skills. These abilities help people overcome obstacles, make wise choices, establish objectives, order chores, and maintain a good work-life balance. They are essential for both personal and professional success. An overview of personal management abilities, their significance, and the main topics they cover are provided in this abstract.Time management, planning, discipline, goal-setting, communication, and stress management are just a few examples of the many facets that make up personal management abilities. These abilities support people in increasing productivity, improving performance, and achieving their goals. Possessing effective personal management abilities is also essential for professional growth, work happiness, and general well-being.The capacity to priorities work, use time wisely, and prevent procrastination are all part of time management. Maintaining an organized and clutter-free workstation, managing electronic and physical files, and using efficient processes to keep organized are all examples of organizational abilities. Self-discipline allows people to retain their drive, attention, and adherence to commitments and deadlines.

KEYWORDS:

Managers, Management, Project, Team, Time.

INTRODUCTION

The ideas, methodologies, tools, and strategies that have been utilized effectively to manage engineering and construction projects were covered in the book's earlier chapters. Engineers who are actively engaged in the present project management practice created and utilize the approaches. The project manager must, however, be aware of emerging technologies that may enhance the ideas in this book if they are to be effective. People sometimes oppose new technologies until they are validated. Despite the availability of technology, it is often not used due of human resistance. Change. A competent project manager will evaluate new technologies and come up with creative ways to integrate it into the project management process. An excellent illustration of the adoption of new technology is the usage of computers. When the computer was initially developed, some people solely saw it as a tool for technical or scientific purposes. Progressive project managers, however, saw the potential advantages of using computers in project management[1]–[3].

Nowadays, almost every step of a project's execution involves a computer. More than any other technological advancement, the computer has undoubtedly altered the way we work today. Similar to the influence of computers, the Internet is a technology that is now in use and has the potential to change how project managers do their business. There are several benefits to managing projects online, but the main ones are time savings and increased

productivity. Information may be sent more quickly to owners, designers, contractors, and suppliers who are spread out geographically. On project-specific websites, correspondence, drawings, and photos may be shared and catalogued for simple access. Important team members may keep an eye on data sharing, which drastically cuts down on the time it takes to make decisions. A request for information (RF'I) may take an hour to complete using conventional techniques, and it might take days or weeks to get a response. RFIs may now be sent electronically, recorded virtually immediately, and often answered the same day or within a few days. With web-enabled project management, designers, suppliers, and contractors are aware of their obligations. Many businesses now use electronic media like the Internet to conduct their business in a paperless atmosphere. Project managers are taking notice of the improved efficiency as they struggle to do more work in less time. Project staff are expected to give outcomes more rapidly as projects get more complicated[4]–[6].

In addition, team members are dispersed across a larger geographic area than in previous projects. Today, design work completed anywhere in the world can be transferred to anyone else in the globe through the Internet very instantly. Transferring papers from one design office to another in different nations allows design work to advance constantly, 24 hours a day. Websites enhance communication both internally and outside. It may serve as an important source of public knowledge. For a project, a corporation may set up both public and private websites. While team members use one website to share specific design and construction information, the general public may visit another to get the most recent updates on traffic conditions and construction timelines.

The private site may significantly reduce the amount of time required for data interchange between the many offices and sub consultants involved in a project. The most popular and often used component of the Internet is e-mail. It permits users to use a computer to send written messages with optional attachments to anybody in the globe for the price of a local call. Drawing files, word processing documents, spreadsheets, images, multimedia clips, and web sites may all be attached. In addition, faxes may be sent through the Internet rather than traditional phone lines.

Systems for managing projects that are web-enabled handle project data more quickly and effectively. For owners, designers, and contractors attempting to complete work as fast and effectively as possible, the methods help decrease confusion and duplication. These systems may be organized with distinguishing tabs to resemble conventional file folder structures. For instance, a company's web system may utilize the Internet to capture delivery records, status updates, and other data in the field and upload it to the database there.

The use of project schedules utilizing an Internet-enabled technology that enables team members to see their assignments across many projects using a web browser is another example. The creation, upkeep, and dissemination of the project schedule are essential to the project management procedure. One may list current and upcoming events on a website using CPM scheduling or straightforward calendar schedules.

A web server may be utilized as the central repository for project materials instead of a local area network. Word processing files, spreadsheets, pictures, and drawings may all be included in the papers. Existing papers may be checked in and out by users of addandlor. Although they may be utilized in the design or construction phases, documents and file systems are most often employed in the design phase.The web may also considerably improve project management. Systems that are web-enabled may control work flow. The programme can produce, log, track, and index project documents in addition to managing them. Other features include task lists, event notifications for project participants, or necessary follow-up

tasks. It has never been simpler to shoot photos and videos and upload them to websites together with papers thanks to digital technology. Complete picture histories may be kept in a database and made accessible online. This may be used to give documentation as the project is being completed and to settle disagreements[7]–[10].

Reports on job costs may also be made public for examination. Without allowing access to an accounting system, restricted access to cost information might be granted for security reasons. Online status reports may include links to further information like timetables, cost reports, RFIs, or accident reports. This offers a method of offering people access to a document-based database that is simple to manage. Another use of project management over the Internet is voice and multimedia. Voice communication may be facilitated through the Internet. Audio and video recordings captured with a digital, still, or video camera may now be attached to emails. A live video stream from an online camera may be accessed by users, and inexpensive gear and software also enables two or more people to teleconference online. This is a useful tool for fixing issues in the field by a group of specialists who may be based in a home office and avoid having to go to the project site. Using intranets and extranets may help with information security. An intranet is a website created specifically for a company's internal usage, sometimes including sensitive information like timetables, bulletins, financial data, and information on the company's human resources. By reducing the number of printed and manually or mail-distributed hard copy notifications and documents, intranets may help businesses save money. An extranet is a website created by a business for shared usage online.

It may include a range of information with restricted or open access for its staff, business associates including suppliers and subcontractors, and the general public. Websites that are tailored to a project fall under this category. The success of project management via the internet offers a huge potential for productivity gains and time savings, but education and training are crucial. To implement new technology, the project manager must be knowledgeable about it and creative. Precautions need to be made while using any new technology. For instance, sending blueprints and data through the Internet might provide additional opportunities for mistakes, omissions, and unauthorized changes. Information may sometimes need to be confirmed as having been received in order to be sure.

The use of the internet is only one example of how technology is being incorporated into the workplace. The project manager must be aware of possible uses when new technologies are created and come up with ways to utilize the technology to boost project management effectiveness[7], [8], [11].

DISCUSSION

When a project is finished and in use, it fills one with a tremendous sense of pride and happiness. Due to the dynamic nature of projects, coordinating engineering and construction presents several difficulties. The project manager and other team members feel satisfied when issues are resolved as they emerge.

The majority of project managers agree that working with individuals on projects results in the formation of lifelong friendships. Years after a project is over, talks between individuals who worked together on prior projects sometimes veer towards humorous recollections of the issues that sprang up and the solutions utilized to address them. In general, the issues seem to be considerably less significant once the project is over than they were while it was being carried out. Successful individuals turn obstacles into opportunities. No matter how challenging a situation may seem, there is always a solution. Most project managers are eager to begin a new project as soon as one is finished. They anticipate the next project and the

chance to put the lessons they've gained from other initiatives into practice. The majority of project managers agree that they like their profession.

Human Aspects

The information that must be obtained and handled to properly complete a project was described in the chapters that came before it. Even if a structure for project management and control must be created, individuals are ultimately responsible for making things happen. The general coordination of a project is guided by a project management system; however the system may sometimes need to be improved or modified for a specific project. People are the sole resource that can identify issues and make the required corrections to properly manage a project. Therefore, a project manager shouldn't only rely on the project management system and undervalue the significance of the stakeholders in the project. To sum up, excellent communication between the individuals doing the tasks required to finish the project is the best way to define successful project management. Any project's management includes coordinating the efforts of people who each have a niche area of expertise. A competent project manager is a good delegate, communicator, and planner.

Some project managers have a propensity to gripe that things outside their control are preventing them from finishing the assignment. For instance, a project manager could think that the team members are too inexperienced, that explaining what needs to be done takes longer than it does to actually accomplish it, or that a team member's error would be too expensive. Other frequent instances include the belief that others avoid taking responsibility or that they are overworked and don't have time for more tasks. Even while these issues are concerning, working with people entails a number of other issues that may be managed well. Prior to being assigned the task of overseeing the job, project managers often had years of experience doing the activity. They could prefer performing the task themselves since they are acquainted with what is needed rather than having it done by someone else. Others. As a consequence of trying to do and manage the work at the same time, they get exhausted, dedicate evenings and weekends to their work, and then whine that the task is not completed because others are too inexperienced. Realizing that people can only get experience by completing the labor themselves;

Moreover, more often than not, employees can do tasks equally as well as or even better than supervisors. Accepting the possibility that others may not do the task precisely as the manager would is the issue. Who can do the task adequately should be the determining criteria rather than who can perform the task well. The project manager must strike a balance between the project's overall accuracy and work quality. By maintaining open lines of communication and receiving instruction, one may get past the perception that one is too unskilled. Project managers often do the work themselves at night or on the weekends because they believe it takes longer to explain the task than to complete it themselves. A person can often do the task more quickly than they can describe what is required to others. However, it is often more effective to teach it to others one time so they are familiar with performing it in the future if the job has to be done on a certain project or on subsequent projects. Project managers must understand that they must first comprehend what has to be done for themselves before instructing others. As was covered in earlier chapters, a clear work plan lays out the course of action for informing team members of their job responsibilities.

The completion of a project often entails large expenses over a long time with many dangers. Every project manager is concerned about the possibility that a human error may be too expensive. Due to this anxiety, a project manager could be hesitant to delegate the task to

others and wind up performing it themselves. The issue is the lack of trust in other people and the worry that, in the event of a crisis, they won't have the necessary judgement to manage it. The common defense is that If you want it done right, you must do it yourself. However, a sound control system will assist guarantee that job is completed correctly. Finding latent talent might be hindered by a fear of taking a gamble. A management could be hesitant to allocate work because they think others won't have time for it since everyone seems to be busy. This seat... “auction often occurs when the task at hand requires specialized knowledge that only a few people possess. To guarantee that all participating in the project are making effective use of their time, a system must be created. The easiest way to do this is to create a clear project schedule from the outset of the project, with involvement and feedback from every participant. There is always time to do the necessary tasks. The refusal of certain personnel to take accountability is another issue that some project managers have. People won't take responsibility if they anticipate unfair criticism if they make a mistake or believe their efforts will go unappreciated. A manager must create a project control system that guards against huge errors that are disastrous while tolerating small errors that are unavoidable. Because some managers want to make all the choices, some individuals just find it simpler to ask the boss than to make the decision themselves. Managing a project requires People prefer to do the job that is expected of them, therefore clearly state the task that is necessary.

Assignment of Work

Since project management entails coordinating work rather than doing it, the project manager assigns tasks to other team members. When you assign someone work, you give them the power and duty to complete the task and to make any choices that may be required. However, the project manager should not give up control while delegating power, responsibility, and decision-making. Different degrees of delegation may be established by a project manager, including completion of the work and delivery of the results, proposal of the work to be done and notification prior to beginning, and performance of just a portion of the work and submission for review and approval. Work must be delegated to the appropriate person with a clear explanation of what is anticipated and when it must be finished. This is management. One must make sure the other person is aware of the assignment since miscommunication is a regular issue in project management. A project manager must offer each team member the chance to do the task in the manner in which they see fit. Simply said, their method of doing a task is frequently as good as mine.

A project manager's expectations should be realistic. The individual assigned to do a work will typically be aware of this reality and reject pressure and responsibility if the assignment is not one that can be fairly accomplished. The best method to determine if it will be possible to complete a job is to collaborate with the individual to define the work that will be needed to produce the intended outcome. A lot of challenges come up when work is being done. A project manager must be available to answer questions, provide clarification, and make any required revisions. In other words, the project manager must be accessible when required. To keep the job moving in a clearly defined way so that everyone involved can work as a team, regular team meetings are required. A competent project manager must guide the team and boost individual confidence.

It is necessary to have faith in their talent, wisdom, and judgements. Any group's leader must sometimes check in with its members to see how things are going and how they are doing. As a result, the team members gain trust and respect from one another and are more likely to work hard to provide high-quality results. A project manager has to acknowledge and celebrate successful and exceptional performance. People are entitled to and enjoy this

acknowledgment. Similar to this, a manager should hold an employee accountable for subpar work and explain why the work is subpar, where errors were made, how to improve the job, and how to avoid difficulties in the future. Many project managers have a propensity to hurry in and take control and are forceful. Each individual has to find their own management style, but they must be careful not to overreact to things. It is possible to turn issues into solutions in due course with the proper mindset and working relationship.

Motivation

Experienced managers easily acknowledge that there are several categories of individuals, including those who cause events to occur, those who observe them, those who are unaware of them, and sometimes those who don't want to know.

The project manager must come up with strategies to inspire each of these groups of individuals. Every team member contributes a skill that is necessary to complete a project. Individual team members are often allocated to the project by their respective supervisors from distinct disciplinary areas. Despite the fact that everyone contributes to the project, each employee may have a separate supervisor. As a result, the project manager, who serves as the team's leader, must inspire people who, in reality, report to someone other than the project manager. Therefore, the project manager must create efficient strategies for team member motivation that go beyond the conventional ways of income or title advancement.

Many managers think that the biggest motivation for people is money. It goes without saying that few individuals would work if they were not compensated. There are other things that affect people's motivation outside money, which may be a motivator to some extent. There are more aspects that need to be taken into account, unless the salary is significantly different. The project manager would struggle with motivation if money were the primary factor in determining each team member's compensation since this is often not the case. Due to the fact that most project managers have little influence over pay rates, they must inspire team members by recognizing them individually and, more crucially, by giving them opportunities to develop and take on new challenges. The topic of inspiring individuals has been the subject of countless publications and philosophies.

The majority of individuals are needs-driven. According to Maslow's hierarchy of requirements, there are five levels of wants that humans attempt to satisfy: basic survival, safety, social, ego, and self-fulfillment. According to the principle, a person tries to meet their fundamental wants for food, clothes, and shelter.

After these requirements are met, a person works towards the next level of need, safety, which may involve maintaining a job, having financial security, etc. The next higher degree of need is sought as each level of need is met. In order to properly encourage the project's participants, a project manager must work to understand their requirements. Since daily tasks make it difficult to do this, it might sometimes be advantageous to connect with people outside of the workplace. Understanding a person's interests and desires is often a beneficial step in comprehending why they behave the way they do and may result in constructive motivation. Each team member's motivating requirements should be taken into consideration when good management devises strategies to boost employee performance. Professionals look for career passion, accomplishment, and recognition. Everyone want both a sense of accomplishment and importance. A project manager should encourage individuals to feel good about themselves because they achieve excellent outcomes. Realizing that everyone has the chance to succeed and living up to their full potential. Team members' attitudes like these may inspire everyone on the team.

CONCLUSION

Personal management abilities are essential for people to properly manage their lives and their job, to sum up. These abilities include a wide range of topics, including goal-setting, communication, time management, organisations, self-discipline, and stress management. People may increase their productivity, accomplish their objectives, maintain a good work-life balance, and boost their general well-being by learning and practicing these skills. The ability to manage one's time well, priorities duties, and refrain from procrastinating is known as personal management. They support people in maintaining their organisations, a well-organized workstation, and efficient file management. Maintaining motivation, remaining focused, and keeping one's word, all depend on one's ability to exercise self-control.Setting goals enables people to specify specific objectives, establish action plans, and monitor their progress towards reaching those objectives. Building good connections, fostering productive work environments, and effectively communicating thoughts and ideas are all made possible by effective communication skills.

The ability to regulate stress enables people to deal with the demands of the workplace, lower their stress levels, and take care of themselves in order to preserve their general wellbeing. A dedication to progress, self-awareness, and continual improvement are necessary for developing personal management abilities. It entails identifying one's strengths and flaws, establishing reasonable objectives, asking for criticism, and actively looking for learning and growth opportunities.

People may maximize their productivity, lower their stress levels, and create a better work-life balance by developing their personal management abilities. These abilities support professional growth, work happiness, and personal achievement. Strong personal management abilities are highly valued by employers since they enhance the organization's overall effectiveness and efficiency.Personal management abilities are more crucial than ever in the hectic and demanding workplace of today. The long-term rewards of mastering these abilities may help people succeed in both their personal and professional lives.

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CHAPTER 10

COMPONENTS OF DECISION-MAKING MANAGEMENT

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ABSTRACT:

A crucial component of management is decision-making, which is picking the optimal course of action from a range of options. Achieving organizational objectives, resolving issues, allocating resources, and adapting to changes in the corporate environment all depend on effective decision-making. This chapter gives a general overview of decision-making in management, emphasizing its significance, fundamental tenets, and the part managers play in the process. Making decisions is a complicated process that calls for acquiring pertinent information, analyzing data, taking into account a variety of possibilities, weighing risks and rewards, and selecting an option using good judgement and logic. Due to their responsibility for selecting choices that are consistent with the goals and strategies of the Organisations, managers play a crucial part in decision-making.Clarity of aims, logic, extensive analysis, taking into account diverse viewpoints, and taking into account both short-term and long-term ramifications are essential components of good decision making. When making judgements, decision-makers should also take ethical issues, cultural considerations, and stakeholder interests into account. Different models and methods of decision-making exist, such as collective decision-making, intuitive decision-making, and logical decision-making. Making judgements logically means using a methodical approach and basing them on logical analysis and objective standards. Making decisions intuitively depends on gut instincts, prior knowledge, and subjective judgement. In order to benefit from a variety of viewpoints and skills, group decision-making includes incorporating several people in the decision-making process

KEYWORDS:

Decision- Making, Information, Manger, Management, Presentation.

INTRODUCTION

The decision-making process involved in project management involves a great deal of time and effort on the side of the project manager. The quality, cost, or timeline of a project may be significantly affected by certain choices, even if many are routine and can be made quickly. Without knowledge of and comprehension of the fundamental objectives and goals that must be achieved, good judgements cannot be made. Making decisions entails selecting a path of action from a range of options. It is the responsibility of the project manager to make sure that all participants are aware of and understand the project's goals so that they may concentrate their efforts on solutions that will provide the intended outcomes. This is crucial since it might take a lot of time and money to evaluate options that could work to tackle a specific issue but have nothing to do with the main goal at hand. To guarantee a concentrated effort, the project manager must coordinate the project team's work[1]–[3].

Making decisions quickly is necessary to avoid work delays that might affect a project's budget and schedule. The majority of project choices are made internally inside the

Organisations of the project manager, which makes them manageable. However, certain choices, especially during the review and approval process, are made externally beyond the project manager's Organisations. Early on in the project, the project manager must identify the tasks that call for outside judgement so that the right information can be given and the decision-maker can be recognized. This has to be included in the project schedule to notify the accountable parties and prevent any delays or interruptions in work due to improper timing of decisions. When managing a project, a project manager may resort to the established rules concerning the decision-making power of many Organisations. However, there are several occasions where speaking with individuals who have experienced similar circumstances may be helpful. Whatever the circumstance, there is nearly always someone else who has had a comparable issue. Even though many judgements are made under duress, the project manager should avoid making them[4]–[7].

To make the optimal choice, one must collect all relevant data, predict probable outcomes, reflect, and then utilize their best judgement. Although it is impossible to foresee every conceivable consequence, one may rule out the implausible ones through diligent consideration and evaluation. Every action has some risk, and even skilled managers sometimes make poor judgements. However, fresh information may become available or new circumstances may occur that will necessitate changing the initial decision. To earn the respect of the team, a project manager must be decisive. Procrastination and hesitancy must be avoided by a project manager, and team members should be encouraged to make decisions. Uncertainty makes most people anxious individuals, which increases anxiety and ambivalence. Many things might go wrong due to a lack of decisiveness, including: no one understands what to do, work is not completed because due to a lack of focus, which wastes talent, money, and time. The project manager must make sure that the right choices are taken by the right people, at the right time, and on the basis of accurate information.

All project participants should be informed of a choice after it has been reached so that everyone engaged is aware of what has to be done. Distributing the meeting minutes or transcript of the discussion with a highlight or flag to indicate the decision may be a simple way to do this. Improved organizational performance, more innovation, better problem-solving, and more employee happiness may all result from effective decision-making. On the other side, making bad decisions may result in resource wastage, lost opportunities, and negative effects for the Organisations. Managers may improve their decision-making abilities by being lifelong learners, asking for feedback, following industry trends, and adopting a growth mindset. It is crucial for managers to provide a decision-making environment that values open communication, fosters innovation, and gives staff members the freedom to share their opinions. Decision-making is a vital component of management and is essential to the success of an Organisations. Clear goals, logical analysis, taking into account diverse viewpoints, and ethical concerns are all necessary for effective decision-making. Making choices that are in line with the objectives and strategies of the company is a big responsibility for managers. Managers may enhance organizational performance and promote an innovative and growing culture by polishing their decision-making abilities and developing a supportive decision-making culture[6], [8]–[10].

DISCUSSION

Several essential elements are involved in effective decision making. First, managers must be clear about the aims and goals they wish to accomplish. This clarity helps them to connect their choices with the organization's overarching strategic direction. Second, decision making requires logic. It entails logical reasoning, weighing risks and rewards, taking into account available facts, and applying objective criteria to guide the decision-making process. Another

critical part of decision making is thorough analysis. Gathering and analyzing relevant information, doing research, and using analytical tools and procedures to analyses the prospective results of each option are all part of this process. Managers must also take into account diverse viewpoints and include stakeholders who may be impacted by the decision. This provides a more thorough and balanced approach.

Time Management

Time is valuable and essential in everyone's personal and professional lives. A project manager spends a significant amount of time speaking and connecting with other project participants. As a result, it is critical that time be utilised productively and effectively. A project manager must exercise caution since there are always more fascinating and valuable things to undertake than time allows. To assess how effective time is utilised, an examination of how time is spent is required. A time diary of how substantial sections of one's time are spent should be kept on a regular basis. Over the course of two or three weeks, a daily record should be kept that indicates how much time is spent on each activity, who was engaged, and what was achieved. Telephone calls, meetings, unplanned guests, and special requests may all be classified as activities. An analysis of the distribution of time by categories will allow the project manager to determine where his or her time is spent the most, allowing for changes. It is typically simpler to decrease a category with a high time expenditure by a modest amount than it is to reduce a category with a low time expenditure.

Unproductive phone calls and meetings are common time wasters for project managers. Although the telephone is required for a manager to do his or her job, it may be quite disruptive. There are times when calls should not be answered so that other activities may be completed. A secretary, assistant, or answering machine may intercept calls to help with telephone management. Meetings are required for project management. Preparing an agenda and distributing it to all participants before to the meeting is the most effective approach to run a fruitful meeting. An agenda is used to concentrate talks and to follow an organised coverage of information that should be given. A brief list of frequent time wasters is provided. The project manager must establish priorities and create a time management system. The least fascinating tasks may be planned while one's energy is at its greatest. A complete evaluation should be conducted to examine job duties that may be delegated to others, as well as an analysis of work to identify how and what can be delegated.

Common Time Wasters

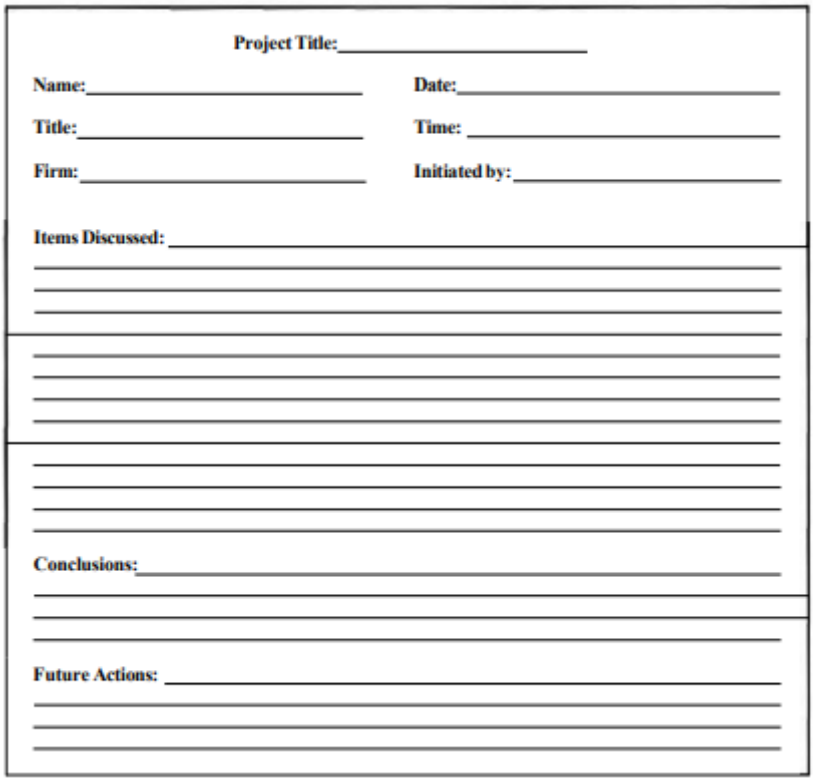
1. Unproductive telephone calls.
2. Unproductive meetings.
3. Unscheduled visitors.
4. Special requests.
5. Attempting too much at once.
6. Lack of goals and objectives.
7. Procrastination on decisions.
8. Involvement in routine items that others can handle.
9. Inability to set and keep priorities.
10. Inability to say no.

Combined or deleted. Long-term goals should be prioritized above short-term goals, which may easily be assigned to others. Most individuals are more motivated by planned labor than by work that just happens at the time. Priorities must be established and maintained in order to properly manage time.

Communications

Miscommunication is one of the most common causes of mistakes and misunderstandings in project management and working with people. Too frequently, the other person does not hear or comprehend the information correctly. Communication may be either oral both speaking and listening or written both writing and speaking. As well as reading. In each case, clear, coherent, and efficient communication skills are required to guarantee that all project participants operate well. The project manager must understand that not everyone interprets the same item the same way, and that communication is useless unless it is both heard and comprehended.

The project manager's function is equivalent to the central server in a computer system's local area network. He or she is in charge of the constant and comprehensive flow of information to and from team members, with a focus on disseminating information and choices that may have an impact on the project team's work. Conversations, meetings, minutes, correspondence, reports, and presentations are examples of these communications. Informal information exchanges among team members accomplish most of the day-to-day work on a project. Telephone conversations and casual gatherings between two or more people are examples. Although the majority of these conversations are routine, some may have an influence on the work of others or project choices about scope, money, or schedule. Informal information exchanges that alter the scope, budget, or schedule must be reported in writing at the next regularly scheduled team meeting. The project manager should keep a record of phone calls, including the names of the people involved, the date, time, and location of the discussion, as well as the subjects discussed.


Project Title:

Name: Date:

Title: Time:

Firm: Initiated by:

Items Discussed:

Conclusions:

Future Actions:

Figure 1: Represting the Individual Telephone Log[AccessEngineeringLibrary].

Add any relevant information gleaned from the interaction (Figure. 1). Telephone records should be copied and filed with each project. It might be useful to have a master phone log that records each call for all projects for which the project manager is responsible. Each call

may be recorded on a single line with the date, time, phone number, person's name, and short notes that offer a summary of the discussion (see Figure. 2). This master log may be linked to the individual telephone record, which provides information on each conversation. A master log is useful for keeping track of the project manager's overall efforts. The project manager must learn and practise effective public speaking abilities. Conversations must be clear, logical, and concise, with no rambling. Before communicating, thoughts and ideas should be organised in a methodical way. This may be accomplished by understanding the communication's goals, such as providing information.Information, to obtain information, to make judgements, or to convince someone. Timing and location must also be considered to ensure that the other person has your full attention, since listening is a vital part of speaking. It is often used. It is vital to follow up on a discussion to ensure that the message was heard and comprehended. This may be accomplished by soliciting feedback.

Date	Time	Number	Name	Company	Project	Remarks

Figure 2: Represting the Project Manager's Master Telephone Log[AccessEngineeringLibrary].

Presentations

As the project's primary point of contact, the project manager serves as the project's spokesman, often making presentations to the owner, agencies, boards, and other interested parties. It is critical to know your audience and to prepare a good presentation. Communicate information that is of value and interest to the audience. A presentation is provided for the benefit of the audience, not the presenter. It should be prepared with the audience in mind and organized in a logical way so that each Parts of the presentation will be related to one another. Problem to solution, unknown to known, cause to effect, or chronological sequence are some

examples. Many presentations have the fault of trying to give the audience too much, delivering a step-by-step breakdown of everything on the topic. A presentation often has a time constraint, and the audience is generally a busy bunch. As a result, the presentation should be more of a summary of key points of immediate relevance, with detailed material left in a report that may be reviewed later. Because only a limited number of graphs, tables, or computer printouts may be shown, they must be carefully selected. A presentation should begin with a title, which is a short summary of the topic, and should be followed by a quick overview of the content to be delivered. During a presentation, the person delivering the topic must be aware that the audience will not recall every word stated. The important points may be repeated to boost clarity and emphasize crucial points by picking various words and phrases to bring forth the same significant concepts. This is required for successful speaking, but it cannot and should not be done in writing since a reader may reread content to clarify or comprehend what is stated.

The speaker should clarify any terminology or acronyms that he or she believes the audience may not be familiar with or comprehend. This should be done when the words are utilized, rather than at the start or conclusion of the presentation. A term that is defined or clarified guarantees that the audience hears and understands what is being spoken. It also guarantees that the audience is thinking about the presentation and focuses on the essential points of the speaker. Visual aids, especially tables of figures, equations, and technical data, considerably improve any presentation. The significance of visual aids is that the audience simultaneously hears and sees the presentation, which considerably helps their comprehension and retention of the material. Visual aids can assist the speaker in keeping the presentation running smoothly. Computers utilized across the business are capable of making slides for presentation purposes using graphically produced data. Current copy machines with enlarging and shrinking capabilities may also be used to create overhead transparencies of printed content, such as laser printer-generated reports.

Few individuals are impressed by elaborate language or the speaker's effort to impress the listener. The degree of information that should be offered is determined by the audience's knowledge of the topic. As a result, knowing your audience is essential. Simple and straightforward language that provides the content in an understandable manner should be utilized.

The speaker should not make the audience feel uneasy in order to capture their attention. Apologies and critical remarks should be avoided. Even while discussing contentious issues, a pleasant attitude should prevail. The presentation should be summarized at the conclusion, just as the audience was informed what the presentation was about at the start. In addition, appropriate time should be set out at the end of the presentation for questions and answers.

Meeting

Throughout the course of a project, several meetings are conducted to share information and make decisions. The timetable for frequent team meetings should be specified as part of the project work plan at the start of the project. The project manager should preside over team meetings, which should be conducted once a week, ideally on the same day and time. Meeting minutes should include things discussed, decisions made, and actions to be done together with the responsible person and the due date. Special meetings may be called on occasion to tackle unusual challenges or circumstances. Minutes from these meetings should be preserved in the project files as well. Other meetings with the owner are conducted to report progress or seek clearances.

Special meetings with additional interested parties, such as regulatory agencies or the general public, may be convened. The project manager may not chair these meetings and is often joined by lead project team members to help in addressing project challenges.

Meetings should be conducted in an efficient way since individuals in attendance are typically busy people with other things to do. An agenda is an efficient way of organizing a meeting since it defines and sequences the issues to be addressed, preventing conversations from straying. When an agenda is utilised to lead the talks, the time required to hold a meeting is also greatly decreased. An agenda may also prevent one person from dominating the debate and allow everyone to participate.

Meetings must begin and conclude on schedule. Those who come on time are penalized, while those who arrive late are rewarded. On the agenda, it is ideal to provide the start and finish times. Sessions with limited time will typically cover as much, if not more, content than sessions with unlimited time. Every formal meeting should have minutes taken. As previously stated, meeting minutes should include issues discussed, choices made, and actions to be done together with the responsible person and the due date. All participants should be given a copy of the minutes, and a record copy should be kept in the project file. Minutes allow each person to double-check the issues addressed and choices taken. Minutes also help the project manager plan the agenda for the following meeting.

CONCLUSION

Management of decision-making is an important component of organizational success. Decision-making is a complicated process that includes gathering information, weighing alternatives, and deciding on the best course of action. Organisations may improve their capacity to make informed and effective choices by employing strong decision-making management practices. Several critical factors are required for effective decision-making management. Defining clear decision-making roles and responsibilities, establishing decision-making processes and frameworks, fostering a culture of data-driven decision-making, promoting collaboration and diverse perspectives, and ensuring transparency and accountability in the decision-making process are all examples of these.Organisations that priorities excellent decision-making management may reap a variety of benefits. They are better prepared to react to challenges and opportunities because choices are taken quickly and with all relevant aspects considered. Effective decision-making also results in improved resource allocation, efficiency, and organizational performance. Additionally, effective decision-making management fosters employee engagement and empowerment. Employees feel appreciated and have a feeling of ownership over the results when they are participating in decision-making. As a result, job satisfaction, motivation, and a more favorable work atmosphere rise. Organisations should give training and assistance to their staff to build decision-making abilities in order to achieve effective decision-making management. Leaders also play an important role in fostering a supportive atmosphere that supports open communication, risk-taking, and learning from errors. Effective decision-making management is more crucial than ever in today's quickly changing and complicated corporate scene. Organisations that priorities and foster an effective decision-making culture are better positioned to handle uncertainty, capitalize on opportunities, and generate long-term success.Efficient decision-making management is a strategic need for businesses. Organisations may make informed choices that lead to good results and advance their development and competitiveness in the marketplace by developing strong decision-making procedures, creating a culture of collaboration and data-driven decision-making, and empowering workers.

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CHAPTER 11

A BRIEF OVERVIEW ABOUT TOTAL QUALITY MANAGEMENT

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ABSTRACT:

Total Quality Management (TQM) is a management philosophy that emphasizes continual improvement, customer happiness, and the participation of all workers in the pursuit of quality. This summary gives an overview of Total Quality Management, including its core concepts and importance in attaining organizational excellence.TQM emphasizes the necessity of surpassing customer expectations by providing high-quality goods and services. It entails a comprehensive strategy that incorporates quality into all areas of an organizations, including its processes, systems, and culture.Customer focus, continuous improvement, staff participation, process orientation, and data-driven decision making are essential TQM concepts. Customer focus requires recognizing and addressing the requirements and expectations of customers in order to increase satisfaction and loyalty. Continuous improvement refers to continual attempts to improve processes, goods, and services in order to attain better levels of quality and efficiency.

KEYWORDS:

Customer, Construction, Improvement, Processes, Quality.

INTRODUCTION

The Total Quality Management (TQM) concept, which emphasizes cooperation at all levels of an organizations to enhance project quality and achieve maximum customer satisfaction, has received considerable attention. Much of this interest stems from the successful use of TQM in the manufacturing and electronics sectors, notably in Japan, where the TQM idea was first introduced in the early 1950s. To achieve customer satisfaction, cost efficiency, and defect-free quality work, the TQM concept focuses on process improvement, customer and supplier interaction, cooperation, and training. Rather of aiming to examine or test the product to attain quality, the TQM management concept focuses on continually improving the process that creates the product. The strategy use statistics to govern the process: management's purpose is not to fix all system issues, but to empower employees with the tools they need to successfully handle system problems[1]–[4].

Much of the TQM idea may be traced back to the teachings of Drs. W. Edward Deming and Joseph M. Juran, who, together with other US specialists, helped the Japanese improve the quality of their goods starting in the early 1950s. At the time, Japanese goods were plagued with flaws and were seen as inferior to those produced by other nations. Deming travelled to Japan many times to give lectures on statistical process control and incorporating quality into the production process. He emphasized that the bulk of industrial issues are caused by the process, and that statistics may be utilized to govern that process. Juran described a management strategy to quality control that emphasized attaining customer satisfaction via a project team approach and project-by-project improvement. He emphasized the need of training at all levels, from employees to executives. In all cases, the focus is on continuous

progress. The Construction Industry Institute (CII) is a national research Organisation created as a consequence of the Business Roundtable's Construction Industry Cost Effectiveness task force report. CII's mission is to enhance the construction industry's cost efficiency by identifying research requirements, conducting research, and aiding in the implementation of the findings. The CII established a Quality Management Task Force to undertake research in the construction industry to identify characteristics of quality management organizations and methodologies seen to be successful in the construction sector.

The task force's goals were to determine the reasons behind the qualities' performance, how they were established and executed, and to offer general principles for adopting enhanced quality management throughout the construction sector. The conclusions of the task force's study are recorded in CII Source Document No. 5 1. The CII task force determined that an integrated strategy of TQM and quality assurance quality control is essential to enhance the quality of the construction industry's goods and services. Construction businesses have taken, with modest adjustments, the TQM techniques and principles employed in the US manufacturing sector and applied them to their operations. The creation and execution of a TQM methodology must be adapted to an organization's particular demands. Aprogram cannot be easily accepted and implemented by a consultant. There must be action behind the words and ceremony, and this can only be done with top management's awareness and engagement. If TQM is to be successful, management must engage in the implementation process and be totally committed to it[5]–[8].

A modest, well-placed pilot project is an excellent way to acquire acceptance of TQM among a company's workers and management. It takes roughly three years for the TQM process to be adopted across an organizations and substantial outcomes to be produced. TQM training will not be successful unless both the technical and humanistic aspects are addressed. The more technical the procedures, the more emphasis should be put on interpersonal and communication skills training. The topics and examples utilized in the training endeavor should be interwoven with the persons being trainer’s real work processes. Employees should begin applying newly acquired abilities to their employment as soon as feasible. Statistical approaches are being utilized successfully in engineering and construction processes to detect and address issues and enhance procedures. Employees and management must first comprehend the underlying ideas of TQM and the objective of regulating and continually improving their processes in order for tracking to be used successfully.

Owners and contractors want better connections with each other, as well as with suppliers and subcontractors. Owners and contractors are entering into partnership partnerships. Both owners and contractors want to limit the number of qualified suppliers they work with. The sections that follow are excerpts from Appendix A of CII Source Document No. 5 1 that describe the basic principles and essential elements of TQM in construction terms, demonstrate their applicability to the construction industry, and outline the TQM process implementation. TQM's fundamental principles are customer satisfaction and continual improvement.

TQM components constitute the framework that supports the customer satisfaction and continuous improvement ideals. Management commitment and leadership, training, collaboration, statistical methodologies, cost of quality, supplier engagement, and customer service are the seven aspects listed in the CII study. Although there is no industry standard for implementing TQM, the CII research identified four steps that have been used to successfully implement TQM preparation and planning, plan implementation, measuring and verifying plan implementation, evaluating results, and moving on to the next preparation and planning stage[9]–[12].

DISCUSSION

TQM's core aims are customer happiness and continual improvement, and hence the ideas upon which it is founded. All efforts in TQM are geared towards the goal of delighting the client by continuously improving on the current techniques and procedures that control the job. The two concepts are interrelated and are realized via TQM elements. The construction industry's role is to supply customers with facilities or structures that fulfil their demands. This service must be offered at a competitive price for a firm to continue in business. TQM is a management concept that effectively assesses the client's requirements and offers the structure, environment, and culture to satisfy those goals at the lowest feasible cost. The quality of the final product will be satisfied by assuring quality at each step of the building process, from conception to completion. Customers might be internal or external. External clients are not employees of the firm that makes the product or service, yet they are affected by it.

The goods in engineering are the plans and specifications, and the clients are the owner and the construction organizations in charge of the construction. In construction, the finished facility is the product, while the client is the building's eventual user. These goods are designed to meet the demands of a high-end consumer. Customers may also be found inside the design company and the construction organizations. Other organizations or persons inside their organizations provide items and information to these internal clients. Satisfying the demands of these internal customers is an important element of the process of providing a quality product to the external consumer. Each partner in the process serves three functions: supplier, processor, and customer. This is known as the triple role notion, according to Juran. These three functions supply, processor, and customer are performed at all levels of the construction process, including corporate, division, department, work group, and individual. This idea is shown in

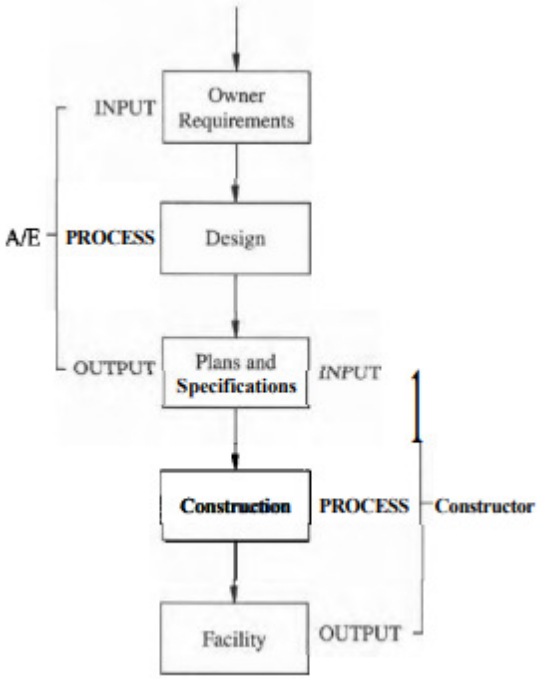

Figure 1: Represting the Juran's Triple Role Applied to Construction [Access Engineering Library].

Figure. 1 depicts an architect engineer (AIE) who is a customer of the owner, a design processor, and a supplier of plans and specifications to the contractor. The contractor is a

client of the AIE's designs and requirements, a builder, and a provider of the finished structure to the owner. The efficacy of the design provided by the A/E business is critical to the overall success of this procedure. As the project advances, the capacity to affect the degree of quality in the completed product decreases. This notion emphasizes the need of obtaining customer feedback, both internal and external, throughout the project planning phases.

Continual Improvement

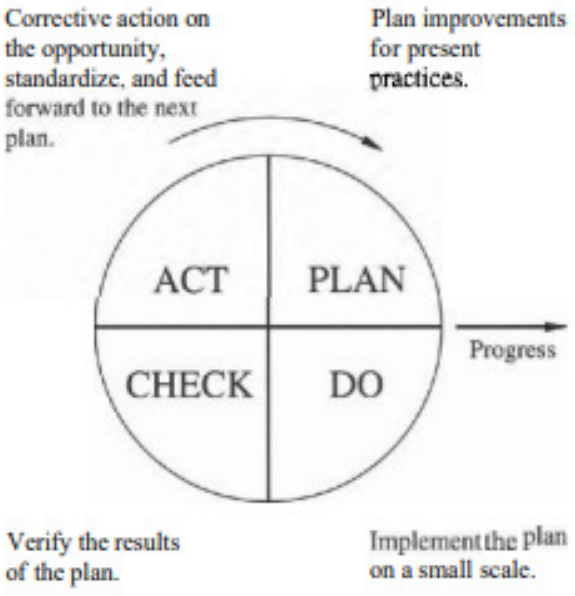

Figure 2: Represting the CII Source Document No. 51[AccessEngineeringLibrary].

Every process may be broken down into phases using flow diagrams, where work flows in, changes state, and continues on to the next step. Within each stage, input changes to output, and the processes and procedures controlling the change of state may be constantly modified to better satisfy the client at the next stage via continuous improvement. Those at each step collaborate closely with their supplier and client following stage to optimise the work process. All phases work together as a team to produce a quality level that will please the consumer. Deming's Plan-Do-Check-Act (PDCA) cycle, seen in Figure. 2, is a problem-solving approach for closing the gap between customer demands and current performance. It is a methodical approach to steadily improve processes and procedures by concentrating on fault rectification and prevention. This is accomplished by addressing the underlying causes of issues and constantly developing and upgrading standards.

The PDCA cycle is made up of four stages that occur throughout time and are continuously cycled. This cycle may be used to all processes, and individual organisations' and functions' PDCA systems can be interconnected and rotated together. Figure. 3 depicts the particular actions that are followed during each phase. The eight phases in Figure. 3 are carried out in a continuous fashion, with two anticipated outcomes. First, to guarantee that processes and procedures are continually improved incrementally, and second, to ensure that previous advancements are preserved. Figure. 4 depicts the dual-purpose notion of the PDCA cycle. The second key duty of management under TQM is to assist the progress of engineering and construction technology and management processes via research and development. Significant improvements in engineering and construction performance may be obtained via innovation. Once established, the PDCA cycle must sustain these high levels of performance.

In order to keep them from deteriorating. Without any attempt to stabilize and upgrade the newly constructed system, its demise is certain. Figure. 5 depicts the relationship between incremental gains, innovation, and maintenance. There is a significant correlation between an industry's vitality and its research and development activities. To stay competitive, the construction sector must invest heavily in research and development. The federal government, as well as materials and equipment manufacturers, fund the majority of research and development.Equipment makers. In general, private engineering and design businesses devote almost minimal money to research and development.

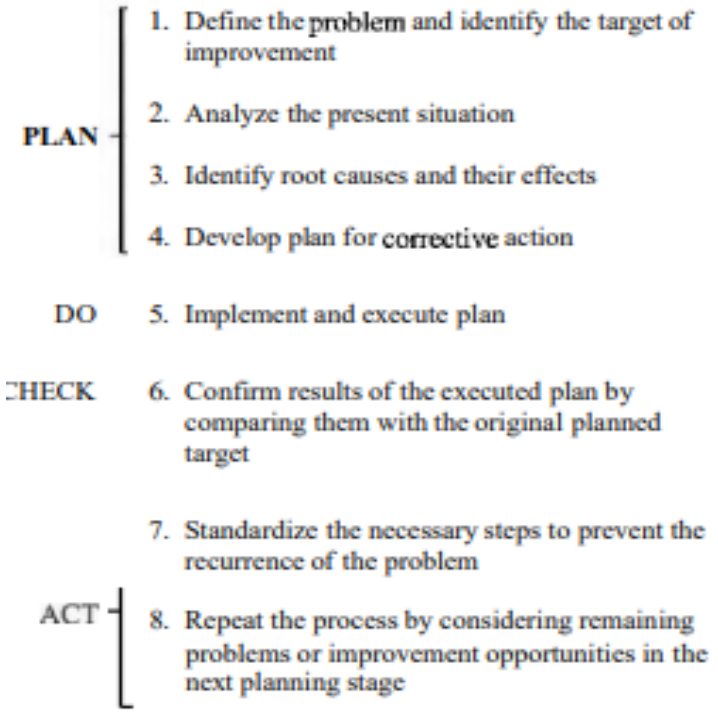

Figure 3: Represting the Specific Steps in the PDCA Process[AccessEngineeringLibrary].

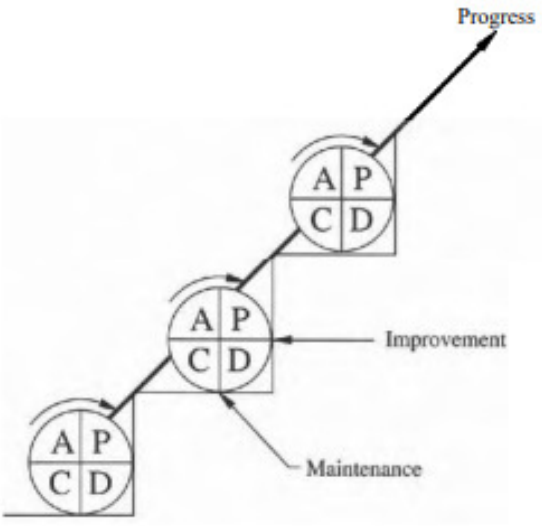

Figure 4: The Dual Purpose of the PDCA Cycle[AccessEngineeringLibrary].

Management Commitment

TQM can only be effective in the presence of a senior management structure that is really concerned about the company's long-term well-being. It is a corporate concept that creates attitudes and improvements that pervade an organisation. Top management must adopt these attitudes and implement them into the company's daily operations. This dedication must be accompanied by a deep grasp of TQM, allowing members of senior management to lead their organisation through a quality revolution. With this passion and understanding, top management can directly develop new corporate objectives and directions and then lead management teams to achieve those goals and directions. The first step for management is to recognise that an issue exists. According to Deming and Juran's 85-15 rule, 85% of today's company issues are generated by the system in which people operate. Management by control, rather than management by participation, is the dominant management technique today. For example, senior management may establish objectives for the next year and then delegate responsibility for achieving these goals to subordinates by putting controls on each of their subordinates.

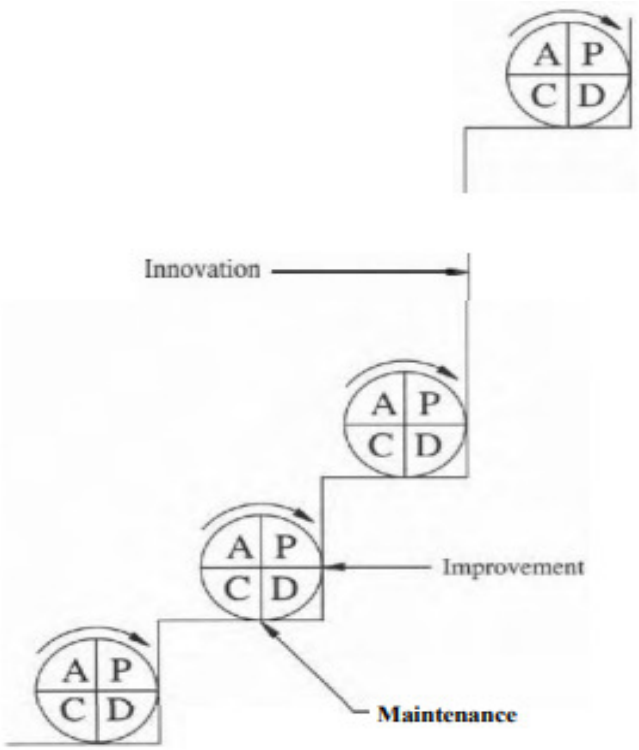

Figure 5: The Two-Sided Effect of Continual Improvement[AccessEngineeringLibrary].

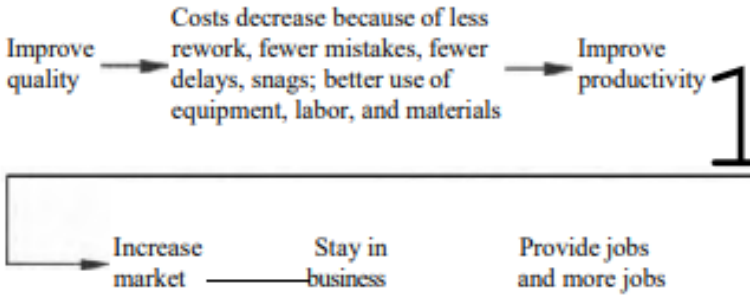

Figure 6: Represting the Deming Chain Reaction [Access Engineering Library].

Each project's cost, timing, and quality targets are specified in construction terms. Project managers in both design and construction are paid for meeting these objectives. Although this strategy has frequently been effective, there are issues when the job is moved by the controls themselves. Individuals and Organisations tend to create compliance when quantitative controls are unachievable or unfeasible. In other cases, there may be inconsistencies in the controls of various departments, which may lead to allegations and hostile relationships. Control management encourages an Organisation to look inside at its own structures rather than outside at the environment in which the customer works. Once management recognizes the bad characteristics of its existing management style, it may begin to grasp how TQM might improve the Organisations. Deming uses a chain reaction process to demonstrate the advantages of TQM (see Figure. 6). Following management's recognition of a problem, the following stage is for management to acquire a comprehensive grasp of the fundamental concepts and elements that comprise TQM. Management may then show their commitment to quality via action.

CONCLUSION

To summarize, Total Quality Management (TQM) is an effective management strategy that emphasizes continual improvement, customer happiness, and staff participation. Organisations may improve their overall performance, competitiveness, and long-term success by using TQM concepts and practices.TQM implementation requires a comprehensive and methodical strategy, beginning with strong leadership commitment and a clear vision of quality excellence. It entails fostering a quality culture across the organizations, in which every person is empowered and encouraged to contribute to the enhancement of processes, products, and services.TQM is based on the concept of surpassing customer expectations by providing high-quality goods and services. Organisations may improve customer happiness, increase customer loyalty, and form strong connections with their target market by concentrating on their requirements and preferences.TQM is based on continuous improvement, as organizations try to continually improve their processes, remove waste, and increase efficiency.

Data and statistical analysis are used to identify areas for development, create quantifiable targets, and measure progress over time. Organisations may improve quality, cut costs, and boost productivity by continually upgrading processes.Another important feature of TQM is employee engagement, which recognizes the value of employee contributions and promotes active participation in quality projects. Organisations may tap into workers' knowledge, talents, and creativity by engaging them at all levels, resulting in inventive solutions, increased job satisfaction, and a feeling of ownership.TQM implementation requires a commitment to data-driven decision making, with choices based on objective facts and analysis. This helps organizations to make educated decisions, uncover underlying causes of problems, and track performance against quality benchmarks. Overall, Total Quality Management offers organizations with a complete framework for achieving excellence in quality and customer happiness. Organisations that embrace TQM ideas and practices may build a culture of continuous improvement, increase employee engagement, and provide better goods and services to their consumers. TQM is a continuous path towards perfection that demands dedication, effort, and an unwavering emphasis on quality.

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