

CHAPTER 1

THE BASICS

Even for the most seasoned professional with years of construction project management experience, it is still beneficial to revisit the basics once in a while, if for no other reason than to “reinforce” what we already know. This chapter provides an overview of project management theory and shows where project control fits into the discipline. It does not offer detailed instruction in the profession of day-to-day project management, but will review the theory of project management and the basic concepts common to the construction industry. The focus will be from the viewpoint of the project manager of the contractor.

The Concept of Project Management

Project management is the professional discipline of planning, monitoring, and controlling specific resources to achieve a predetermined set of goals for a project. The term *project* is defined as a one-time endeavor with well-defined, often unique, goals, with specific limits of both time and cost to achieve those goals. The temporary nature of a project is in contrast to businesses like manufacturing that are repetitive by nature. This type of management has predefined systems or processes that have been refined over time. The management of a project, in contrast to manufacturing, requires a different paradigm and skill set on the part of the practitioner. The project manager’s main test is to achieve all of the goals, including the deliverables, within the constraint of a fixed budget and fixed time frame. Specific goals and deliverables in the construction industry will vary from project to project, but will always be within the parameters of satisfying the contractual objectives of time and cost.

For the purpose of this text, let’s refine the definition to reflect a project as defined by the construction industry. Project management in the construction industry is the professional practice of planning, scheduling, monitoring, and controlling a finite amount of resources—materials, labor, equipment, and subcontractors—to achieve a set of goals, which are usually a series of engineering improvements for a unique one-time event, the

project. To compound this definition, planning, scheduling, monitoring, and controlling must occur within a defined duration and a frequently fixed budget. To further complicate the process, let's add some unpredictable factors such as weather, labor strikes, material shortages, supply chain variables, and a wide range of separate goals and conflicting agendas proposed by the participants. Lastly, let's not forget the ever-present threat of financial penalty as a "reward" for failing to master all of the above challenges!

History of Project Management

The concept of project management is not new. It has been practiced since human beings noticed the need for improvement in their surroundings. There is a near 100 percent chance that the construction of the Great Pyramids of Giza had a project manager or multiple project managers over time. Rather than bore the reader with recounting the development of project management since the dawn of the Bronze Age, let's consider what's important.

As a professional discipline, project management emerged as construction projects became more complex and warranted an individual to be accountable for the performance and results. Techniques for managing projects started to develop at the dawn of the twentieth century.

Much of the credit for the development of project management techniques can be given to two early pioneers: Henry L. Gantt and Henri Fayol. Both Gantt and Fayol were students of Frederick Winslow Taylor's theories of scientific management.

Henry L. Gantt (1861–1919) was an American mechanical engineer who later became a management consultant to the steel industry. He worked with Taylor until 1893, applying scientific management principles to the production of steel. Gantt is called the father of planning and control techniques in project management. He is most recognized for the development of a visual management tool that displays a task as a function of time. It is used to measure actual progress against planned progress. The tool was aptly named the *Gantt Chart* and is still very much in use today.

Gantt's 1919 book, *Organizing for Work*, describes two principles of the Gantt Chart:

- Measuring activities by the amount of time needed to complete them (task duration)
- Representing the quantity of the task that should have been done in that time (daily output)

Both of these principles have a direct applicability to construction. Gantt was one of the first to recognize that in order for a team of workers to produce efficiently and to maintainable standards, the team needed an intelligent leader who could solve or preempt problems, and provide guidance to control the outcomes of certain actions.

Henri Fayol (1841–1925) was a French mining engineer who developed a general theory of business administration later referred to as *Fayolism*. Fayol believed in analyzing the role of management to reduce problems and to increase worker efficiency. Fayol is credited with the creation of the six management functions that are still the basis of project management today;

- Forecasting
- Planning
- Organizing
- Commanding
- Coordinating
- Monitoring

Fayol's book, *General and Industrial Management*, published in 1916, outlined a flexible theory of management that could be applied to most industries. The book stressed the importance of planning as a way to improve efficiency and control the outcomes.

With the dawn of the 1950s and the increase of the military-industrial complex to offset the threat of the Cold War, modern project management really came to life. Project management became a recognized stand-alone professional discipline. This decade saw the development of two mathematical models for project scheduling that added to the project management toolbox. The *Critical Path Method*, or CPM as it is more commonly known, was developed for managing maintenance projects by two U.S. industrial giants; DuPont and Remington Rand. The second method, *Program Evaluation and Review Technique* (PERT), was developed as part of the U.S. Navy's Polaris missile submarine program. These mathematical techniques for scheduling were quickly adopted by the construction industry.

At the same time these scheduling models were being developed, advances in technology were evolving in cost estimating and cost management and control. Combined, these techniques gave birth to the discipline of project control.

Approaches to Project Management

There are several approaches to managing project activities, each with special characteristics. Depending on the particular perspective of the project manager (owner, design professional, constructor, etc.), one approach may be better suited than another. The approaches are as follows:

- **Traditional Approach:** The Traditional Approach identifies a series of phases that drive the project. In the Traditional Approach there are five distinct steps:
 - Initiation
 - Planning
 - Execution
 - Monitoring and Controlling
 - Completion

The Traditional Approach and the individual processes within it will be discussed in more detail later in this text.

- **Critical Chain Project Management (CCPM):** CCPM is a fairly new technique of project management that puts more emphasis on the resources needed to do the project tasks. It is an application of the *Theory of Constraints* (TOC) where the goal is to increase the completion rates of projects within an organization. There are five steps that CCPM focuses on:
 - Identify the constraint.
 - Exploit the constraint (do what is required to ensure the constraint works at optimum capacity).
 - Subordinate all other tasks to the constraint (the constraint is given priority).
 - Elevate the constraint (obtain more of the constraint).
 - Repeat the cycle.
- **Extreme Project Management (XPM):** XPM is reserved for very complex and uncertain projects often associated with software development. It focuses on the management of human resources versus formal scheduling techniques.
- **Agile Project Management (APM):** APM employs a nontraditional methodology similar to XPM. It requires a complete rethinking of the traditional processes. APM has its greatest applicability in the software development business, but has also been adapted to complex construction and design projects.
- **Event Chain Methodology:** This is an uncertainty modeling and schedule analysis technique that focuses on the management of events and event chains that affect the project schedule. It is often a complement to the CPM schedule technique. Event chain methodology is used to perform more accurate quantitative analysis while considering such factors as relationships between different events and actual timing of the events.

As one can imagine, not all of the aforementioned methodologies are applicable to the construction industry. Regardless of the approach selected, a detailed analysis of the overall goals of the project, the available time for performance, the budget, and the roles and responsibilities of the participants is primary.

The Traditional Approach

As an overall methodology for the average construction project, the Traditional Approach has the greatest applicability. This methodology is often called the waterfall approach because of its linear execution: the predecessor task must be completed before starting the successor task.

If one were to analyze each of the five steps in the process, it would quickly become apparent where the steps fit in a construction project.

The Initiating Process

The *Initiating Process* determines the nature and scope of the project. What is the need, will this project satisfy that need, and can the need be accommodated within the client's budget? This is where the client's expectation of what they will receive, in the form of the project, will be tempered by what the client can afford. This particular phase must be done correctly as the rest of the program will be driven by its outcomes. Incorrect assumptions about the business model, industry growth, or the economic environment, to name but a few, may result in a project that does not satisfy the client's need.

The Initiating Process should address the following:

- Define the current business model.
- Review current practices or operations.
- Define expectations for growth.
- Analyze the business needs in measurable terms.
- Obtain consensus on needs from stakeholders/end users.
- Analyze financial cost and benefits.
- Decide to go forward with the project.

It is common for the design team or the construction manager to perform the majority of the processes in the initiating phase with the owner's concurrence. This may be part of the feasibility analysis of the program long before the project goes out for bid to contractors.

The Planning Process

The *Planning Process*, sometimes called the planning and design process, investigates and evaluates the best method in which to achieve the expectations (goals) defined in the Initiating Process. The Planning Process further identifies the scope and parameters of the project: time, cost, and resources. The Planning Process often identifies the team and its hierarchy.

The Planning Process includes the following steps:

- Select the planning team (in-house and/or outsourced).
- Assign responsibilities to team members and contributors.
- Develop the scope of work statement.
- Identify the resources required to perform steps in the plan and the availability of those resources.
- Identify and evaluate potential means and methods for the project.
- Estimate the cost to achieve the goals: the budget.
- Identify the time available for performance.
- Break the deliverables down into phases (if appropriate).

- Perform a risk analysis and create a risk management plan as a result of the analysis.
- Decide to go forward with the project.

The success of the Planning Process often defines the success of the project as a whole. A separate way to define the Planning Process at the contractor level would be to consider the brainstorming and planning that go on between project manager team members when they create the plan and determine how the work will be executed. The goal is to arrive at the *means and methods* for performing the work. Means and methods is the “game plan” for performing the work, and this is the expertise that the contractor brings to the table. While the contract is required to be executed in conformance with the plans and specifications, there are different ways in which the work can be performed. The goal of the plan is to execute the work in the most cost-efficient and timely manner. It is the balance between time and cost.

The Executing Process

The *Executing Process* is where the Planning Process is put into action. It is where the work gets done and resources strive to achieve the project goals. Executing involves coordination of the resources to meet the project deliverables within the time and budget. It is a combination of leadership and management techniques aimed at getting results. It is also where the individuals managing the process advise the management and planning team of what portion of the plan works and what portion of it needs to be adjusted. This is called the *feedback cycle* and is crucial to achieving the project goals. The feedback cycle will be discussed in more detail later in this text.

The Executing Process should include the followings steps:

- Select or contract with the resources that will perform the work.
- Select a methodology for the individual critical tasks.
- Develop a schedule (CPM) for performance of the work.
- Execute the tasks in accordance with the schedule.
- Execute the tasks in accordance with the plan.
- Establish the metrics for performance measurements (create a baseline to measure performance against).

While an argument could be made for several of the previous steps to occur in the Planning Process, the team that does the planning may be different than the team that performs the work. Therefore, as professionals, those who perform the work should have some latitude as to what means or method works best. The plan is often refined during the Executing Process. However, it is not revised at the cost of losing sight of the efficiency goals.

The Monitoring and Controlling Process

The Monitoring and Controlling Processes, while separate, are performed together. They consist of a series of steps to observe the executing process. It is the establishment of a guidance system or a set of metrics by which actual performance can be measured and compared to planned performance. It is the part of the project where the differences between planned and actual performance in both cost and schedule, called *variances*, are analyzed. If required, a series of inputs called *corrective actions* are implemented to achieve the original desired outcome based on the plan. They help to guide the project back on to the track of the original plan. This is a crucial step in the process, without which it is impossible to determine how well the project is performing.

The essence of any type of management is control. It is fundamental to project management; if one is to manage, one must control. *Wideman Comparative Glossary of Project Management Terms* v3.1 defines control as: “The process of comparing actual performance with planned performance, analyzing the differences, and taking appropriate corrective action.” This process, if performed correctly, offers the distinct benefit of knowing the project status at all times.

The Monitoring and Controlling Process includes:

- Updating metrics for performance measurements (baseline).
- Measuring the performance of ongoing tasks (during the Executing Process).
- Monitoring of the project variables (cost, time, resources, and quality) against the baseline.
- Analyzing the variances between baseline and actual, and their cause.
- Identifying and implementing corrective actions to get the actual back on track.

It also includes a variety of ancillary tasks that become part of the process, such as change management and value engineering. The performance baseline identified in the first step is often developed in the Executing Process and updated or adjusted as the work progresses.

The Closing Process

The process for formal acceptance at or near the end of the project is called the *Closing Process*. In the construction industry, this is called “Project Closeout.” In the framework of the construction execution, it is ongoing from Substantial Completion (beneficial use and occupancy) to Final Completion.

The Closing Process includes:

- Development and completion of punchlist tasks.
- Finalizing of record documents.

- Training of owner personnel.
- Turnover of operations and maintenance manuals.
- Archiving of project files.
- Accounting and closeout of a contract.
- Conducting a lessons-learned meeting.

This is a critical part of the overall project and a necessary step to a successful project.

If one were to follow the aforementioned processes through a construction project, it is easy to imagine how the client (owner) would use each process to expand its operations by constructing a new manufacturing facility. It could also be applied to the general contractor recently awarded the contract to construct the facility or to the design firm awarded the contract for the documents. Each member of the team performs similar steps to manage their portion of the project.

Benefits of Proper Planning

Each process in the Traditional Approach to project management is crucial to its overall success. Each step has distinct contribution to the next step in the process that allows that next step to build upon the previous one. This is referred to as the *waterfall model*. The waterfall model is successful in the rigid environment of the construction industry where changes after the fact can be cost-prohibitive. However, for the construction professional, each step or process may hold a different weight based on its contribution.

For example, the architects and engineers charged with designing the project place a heavier weight on understanding the client's needs and translating that into a program that can be conveyed to those who must construct it. Like most professions, architects and engineers can specialize in the design of hospitals, offices, churches, and just about any unique use a structure could have. It is a result of knowing the proper questions to ask the client and how the responses can be put on paper. However, if they do not understand the client's needs, the design is destined for failure.

Contractors that will construct the project may place more weight on the Planning Process. Proper planning forces detailed thinking about the project. It allows the project manager (or team) to "build the project in his or her head." The project manager (or team) can consider different methodologies, thereby deciding what works best or what does not work at all. This detailed thinking may be the only way to discover constraints or risks that were not addressed in the estimating process. It would be far better to discover in the planning phase that a particular technology or material will not work than in the Execution Process.

The goal of the Planning Process for the contractor is to produce a workable scheme that uses the resources efficiently within the allowable time and allotted budget. A well-developed plan does not guarantee that the Executing Process will proceed flawlessly or that the project will even succeed in meeting its objectives. It does, however, greatly improve its chances! The most significant contribution of the Planning Process is the baseline that is essential in the performance of project control. Without a thoroughly developed plan, what would the contractor use to measure progress?

When the plan is set to time, it becomes the schedule. Construction scheduling is done by professionals who are familiar with the construction process as it is performed in the field. It requires an in-depth knowledge of construction methods and an ability to visualize tasks and their interdependencies with other tasks. Knowledge is gained in the Planning Process that is beneficial in developing the schedule.

While the schedule does not require a consensus of all of the participants, it does require input from those who will perform or manage the work in the field. Superintendents, foremen, subcontractors, and vendors can add valuable insight and perspective as to how the work should be performed. Subcontractors can often flush out the details to fit within the prime contractor's schedule. Allowing the participants to contribute not only adds to the knowledge base about the project, but it also creates *buy-in*. Buy-in is the agreement by a project participant to support an idea or decision because they were allowed to contribute to the formation of that idea or decision. Buy-in is an essential element to a project's success. When a participant offers a suggestion that is then incorporated in the plan or schedule, there is a natural desire by that participant to see his/her suggestion succeed. This desire is often followed up with a series of actions that ensure the success of the suggestion, all of which is the result of proper planning.

The Role of the Project Manager

Up to this point, the book has discussed the concept of project management from a generic point of view. Going forward, it will be helpful to have a particular perspective. The viewpoint will be that of the project manager for the contractor. The author has specifically omitted "sub-," "prime," or "general" before the word "contractor" (except where absolutely necessary) so as not to alienate other frames of reference. With very little imagination, the ideas and concepts presented here are synonymous with most contracting companies in the construction industry.

To understand the role the project manager plays in the contractor's office, it is essential to understand the term *project* as it relates to the

construction industry. Construction projects for the most part are unique, dynamic, and complex. In some less than temperate climates, the exact same building constructed on the same property in two different seasons of the year can be totally different projects. Projects are affected by their owners, design professionals, and contractors as well as the relationships that are fostered between the parties. Professionals who cooperate and execute their responsibilities in a timely manner further the interests of the project, and those who do not—hinder its progress. Projects change constantly; they are dynamic in nature. Expecting otherwise is naïve. Managing that change is the essence of successful project management.

Summarizing the previous paragraphs, the role of the project manager in construction can be distilled into three actions: *plan*, *monitor*, and *control*. While there is nothing simple about the actions and skills required to complete each, almost every action can fit into one of those actions.

So how does the project manager fit into the process?

Lead the Project Team

The project manager, or PM, is the point person responsible for the project. He or she is accountable for wins and losses on both the schedule and budget. They are tasked with utilizing the company's money, equipment, human resources, and internal core competencies efficiently. The project manager heads the contractor's project team and is the lead decision-maker. The project team can be defined as the contractor's employees: the supervisor, and tradespersons directly employed by the contractor, subcontractors who will perform work on-site, vendors who will provide specific equipment or fabricated items to the site, and the suppliers who will provide essential components such as ready-mix concrete, lumber, and building materials.

The project manager will lead the team in other ways as well. They include representing the contractor's team in meetings with the owner and architect/engineers, lenders or investors in the project, organized labor groups, and local governmental agencies or committees having jurisdiction over the project. The project manager will be responsible for reporting to account executives or senior management on the company's performance on that project. The PM's decisions and communications will be viewed as the official decisions and communications of the contractor—the legal voice of the contractor.

Create the Project Plan

The project manager leads the team that is responsible for creating the project plan. On some small projects the PM may be the entire team. As previously discussed, the project plan is the workable scheme to accomplish the project's intended goals. The PM must devise the scheme within the

confines of the contract documents, contractual constraints, and the available budget as defined by the estimate. It has to be above all a realistic plan that can be achieved by normal humans. The plan has to consider all of the resources that will be required and the most expeditious and efficient use of those resources. Unpredictable events, such as material shortages, supply chain delays, labor strikes, and price escalations, and even the weather must be taken into account in the plan. The plan must have measurable events or deliverables that can be used to assess whether the plan is working, and the team is achieving its goal.

The project manager will assemble, oversee, and assume responsibility for those individuals and companies who are best suited to execute this plan. He or she will be responsible for analyzing which key trades are critical to the success of the project. The PM must identify the areas of high risk and work aggressively to mitigate the risk. Lastly, the project has to meet the parameters set forth in the contract for performance and quality. Above all, the plan has to be accomplished within a definitive timeframe.

Develop the Project Schedule

With the exception of large contracting companies that can afford the luxury of a dedicated project scheduler, the duty of developing a schedule is typically the responsibility of the project manager. Even for the simplest project, the schedule is a complex, ever-changing, and project-specific management tool. The schedule decomposes the project into the individual tasks that comprise the whole. It organizes these tasks in chronological order, and clearly illustrates the interdependencies between them. The schedule enumerates definitive, recognizable milestones or intermediate goals, all of which are set as a function of time.

Each of the tasks on the schedule, referred to as *activities*, has a party responsible to execute it, called the *resource*. Those parties may be subcontractors who have a continued interface on the project, such as the electrician or HVAC contractor, or single application subcontractors who are on and off the project relatively quickly, such as the damp-proofing expert or the toilet partition installer.

In addition to the actual production activities, there are also administrative and procurement components such as submittals and lead times that are incorporated in the schedule and have a direct impact on progress. The schedule should also include activities by outside parties such as the owner or building inspectors whose performance impacts the project's progress. Once the schedule has been accepted by the team, it becomes the baseline for comparison of the actual performance of the work. This is key to project control. It is impossible to determine if a project is ahead or behind if there is nothing to compare it to!

Monitor the Progress of the Project

In order to determine if the project is on schedule and in accordance with the plan, the project manager is required to monitor the progress of the work. This requires more than a cursory review of progress. As the work progresses, the schedule has to be updated to reflect actual performance. The monitoring portion of the Monitoring and Control Process is meant to establish a comparison between the actual progress and the anticipated progress of the project as defined in the schedule. The monitoring reveals which activities are ahead of schedule, on schedule, and, most importantly, behind schedule. The monitoring is based on *feedback*, an essential part of the decision-making process. Feedback comes in many forms: verbal communications, written daily reports from the field, labor-tracking reports, material deliveries, milestones achieved, and upcoming activities. Without the feedback, there can be no effective monitoring or informed decision-making. The monitoring also includes oversight of the costs that are incurred as the work is performed.

Control the Project

One of the most important responsibilities of the project manager is to control the project. Control in most cases can be defined as making decisions proactively instead of reactively to guide the direction of the project. Decisions must be made by considering all of the information available at the time and acting in the best interest of the project. Controlling the project includes adjusting both the plan and the schedule when things change, as they inevitably do. The PM must remember that there are always alternate methods for achieving the project goals. It is impossible to be proactive in every situation; occasionally, crisis management is the topic of the day. Great plans sometime change, and sometimes they just plain fail altogether. Unfortunately, that is just the nature of the business. How quickly and cost-effectively the PM can get the project back on track is the essence of great project management!

Take Corrective Action

When the progress of the project falls short of the plan or deviates from the schedule, the project manager must be willing and able to take immediate and effective action to correct the deviation. The corrective action runs the full spectrum from written directives to termination. The actions necessary are determined as a result of analyzing all of the data in the feedback cycle, discussing the options with team members, and considering any potential consequences of those actions.

It is essential that corrective action is applied in a timely and professional manner. Implementation of a corrective action has one goal, and that is to bring the project back on schedule. It is never intended to be punitive.

Not every action will have the desired or intended effect. In fact, it is not unusual for the corrective action to have no positive impact at all. Recognizing the mistake and switching to Plan B is often the next step in the process. This project manager should not chalk this up as a failure, but as a step in the process of getting the project back on track. Inaction or waiting for the problem to correct itself are often far worse than taking the wrong action.

Achieve the Project Goals

In summary, the main duty of the project manager is to achieve the project goals. The planning, scheduling, monitoring, and controlling of the work are all designed and intended to further the project goals.

Goals of the Project

The goals of the project are the goals of the project team. As the lead on the project team, the goals of the project manager are synergized with the team. They are the result of a clear understanding of the project documents made evident during the Planning Process. Some of the goals are contractual in nature, and some are imposed by the senior management. Understanding those goals and keeping them on target and in the focus of the project team is paramount to the success of any project and a primary responsibility of the project manager. Many projects become hopelessly derailed because the team loses focus of the goals or, worse, were unclear about what the goals were in the beginning.

Contractual Performance Obligations

At the top of the list of the project goals is achieving the contract obligations. Every contract for construction has specific requirements for performance. These include standards for quality of materials and workmanship, specific deliverables, such as phases, and the most significant performance requirement: Substantial Completion. In their simplest terms, contracts define quality, time, and price. It is the primary goal of the project team to meet the performance requirements of the contract. Failure to meet these obligations can render the remaining goals on this list unattainable. The project manager and the project team must have a thorough understanding of the contract requirements and deliverables. There is no shortcut to this step.

Financial Objectives

While it may sound shallow or ignoble of purpose, all project managers are tasked with meeting (or exceeding) the financial goals outlined in the estimate or by the project team. That means the project should contribute its share to the company's financial bottom line. As with any for-profit business enterprise, making a return for managed risk is one of the determinants of project success. Project managers are often the gatekeepers to the profits. They are charged with the task of maintaining the estimated profit carried in the bid, in addition to the profit that comes from negotiating, effective decision-making, controlling the participants, and superior management of the schedule. In the eyes of most construction executives, one of the most important measures of a successful project is the net profit it returns to the company's balance sheet.

Prevent or Minimize Delay

The scariest word in the construction lexicon is "delay." The principal reason is that recovery from delay can be very costly, if even possible. Every project has tasks that fall behind, but with proper guidance are brought back on track. Delay can become chronic when the entire project is behind on the project schedule. Once a project has experienced a delay, it can provoke a host of claims from the affected parties: claims of losses from the owner, claims of material escalation costs, acceleration costs from subs, imposition of liquidated damages, and even additional charges from the architect and engineers for extended services. Resolving delay disputes is time-consuming and distracts the project manager from his or her more immediate responsibilities in managing the project. Careful monitoring of a project schedule and control of the contractors performing the work can prevent or minimize delay. Gaining minor leads and exploiting them can often provide a little cushion to any potential delay.

Avoid Claims or Litigation

Disputes arise on every project. It is in the very essence of what we do. Disputes give rise to claims. Claims for additional work as a result of delay, acceleration or escalation costs are normal occurrences on a construction project and should be dealt with in the life cycle of the project. Those claims that can't be substantiated and approved in the normal course of business often end up with a third party overseeing the resolution of the dispute. Preparing to litigate, arbitrate, or mediate a dispute is a burden on the project manager's time and can be all-consuming. Since most actions to resolve disputes occur well after the incident, the project manager must review and study the project records and become

re-acquainted with the details. Avoiding claims or possibly the resulting legal actions is a primary responsibility of the project manager. It can very quickly turn a financially successful project into a loser.

Control the O-P-C Relationship

The O-P-C relationship is the tri-party arrangement most often used in the construction industry under the design/bid/build delivery methodology. The Owner (O) contracts with the Professional (P), most often an architect or engineer, for design and administration services. The Owner (O) also contracts separately with the Contractor (C) to construct the physical project. While there is no direct binding agreement between the professional and the contractor, there is a requirement that they cooperate in the best interest of the owner to complete the project. As the party with the most financial risk, it is the project manager for the general contractor who needs to control the O-P-C relationship as well as the project team. The project manager must strive to earn the respect and trust of the architect and the owner so that he or she can be the proactive force in managing the project, instead of reacting to the wishes of the professional and the owner. A strong PM with a clear understanding of the project and its unique features, who can direct the work and maintain the project schedule, is the hope of every owner and design professional for their project. A PM who can demonstrate these skills and lead instead of follow will often be given a greater latitude by the owner and design professional.

Increase Market Share

In all businesses, a successful engagement, a well-executed contract, or the sale of a product that performs as advertised should increase business and add to a company's market share. The construction industry is no exception. There is only so much advertising that a company can do. Successful performance adds to a company's reputation and ultimately its bottom line. As the old adage goes: "The proof is in the pudding." While it may not be the primary goal of the project manager to increase business, it should be an ancillary goal. It is the by-product of a project done well, and a reward for superior performance by the project manager. It also has the distinct advantage of preventing the PM from "being made available to the industry."

Role of the Contract Documents

The contract documents, sometimes referred to as the CDs, are the plans and specifications, plus any addendum provided during the bidding process. These documents are the basis of the contract. The plans are the quantitative portion of the project, represented graphically. Quantities associated

with any activity or material incorporated in the project are determined from the plans. The technical specifications are typically separate from the plans and are bound in the project manual. They define the qualitative portion of the project and address the characteristics of the product and the acceptable tolerances of the workmanship. The plans and specifications are meant to be used together; neither is meant to exist as a stand-alone document. The CDs establish the standard by which the performance of the contractor is measured. Through the plans and specifications, the documents define the quality and parameters for performance. If the contractor has performed in accordance with the contract documents, then the project should be successful from a performance standpoint. The CDs are the most valuable tool that the project manager has in his/her toolbox when managing other team members.

Study the Plans and Specifications

Long before the commencement of any physical work on the site, and prior to subcontracts being let and materials purchased, the project manager should *study* the plans and specifications carefully and thoroughly. As the word implies, study is far more than a casual review. A careful and thorough study of the contract documents is the project manager's education on the project. This is most often done in a quiet setting without interruptions from the phone, e-mail, coworkers, or the normal day-to-day disturbances that demand the project manager's attention. It is helpful to have a pad of paper and pencil for notes as the study takes place.

The project manager should review in detail each and every page of the plans and technical specifications. There are many reasons for the in-depth study, the least of which is to find the design professional's mistakes. While it is implied that the plans and specifications are reasonably accurate and complete for their purpose, design professionals, just like contractors, are human, and humans make mistakes!

The purpose of the study is to ensure coordination between the plans and specifications. It also has the benefit of identifying long lead items. The study is best carried out in the same sequence as the structure would be built. There is a natural "trigger" that prompts the project manager into asking: "What's the next step?"

Often in the heat of the bidding phase, questions are asked that require a written response that changes the bid documents. When that occurs, the architect or engineer will issue an *addendum*. Addenda (pl.) are sometimes hastily issued documents that can convey simple changes or have complex and far-reaching implications on the contract documents. Each addendum has to be reviewed in the context of the entire project and schedule. Lastly, it is helpful to ask the estimator his or her opinion on the completeness

of the documents. The estimator may have already addressed many discrepancies during the bidding process.

During the bidding process the estimators learn a tremendous amount about the project. This is helpful information that should not go to waste now that the bid has been won. Estimators make assumptions during bidding. They ask questions and have conversations with subcontractor bidders. The estimators should share those assumptions, answers, and conversations with the project team. The best way is through a formal process in which the estimators share what they learned in the bidding phase. This gives the PM and team a head start in becoming familiar with their project.

Identify Discrepancies Early

The purpose of identifying discrepancies early is to avoid costly errors that can delay the progress or give rise to a claim or extra charge. Early detection allows the architect or engineers more time and a wider array of options to correct or clarify a discrepancy. Discrepancies that are discovered by the project manager before they become critical can be controlled and allow the project manager time to propose a solution before one is thrust upon him or her. The mere act of suggesting a solution, whether or not it is accepted, shows interest in the project. This has the added benefit of establishing the project manager as a partner or ally in the construction process instead of as an opponent.

Visit the Project Site

It's essential that the project manager take whatever time is necessary to visit and become familiar with the project site. Other team members such as assistant PMs and the superintendent should also visit the site. The site visit should *only* occur after the team has become familiar with the plans and specifications. The team must understand the physical aspects and uniqueness of the site *before* work commences. This is true about a new site, a renovation, or the addition to an existing building. Specific attributes such as utility pole location for power and telecommunications, water service connection points, and difficulty in accessing the site for large equipment or delivery vehicles are examples of the information that can be derived from a site visit. Natural features such as rock formations that may hinder excavation are another example. The existing condition of structures that are being added on to, or evidence of hazardous materials that are not identified in the documents, are all tangible benefits of site exploration. Again, the earlier the project manager takes the lead in learning about the actual site conditions and its limitations, the sooner that information can be disseminated to the rest of the project team.

Understand the Project Constraints

All projects have constraints. Probably the one that most construction professionals are familiar with is the time available for construction. Some constraints are contractual or imposed by the documents. Others can be a result of latent site conditions. Examples of contractual restraints include:

- Project phasing that prevents starting phase two until phase one has been completed and accepted.
- Occupied space that requires working around a business that is maintaining its operations.
- Utility changeovers that must occur during off-business hours.
- General context or process requirements,

Constraints that are a result of the site conditions include:

- Proximity to other structures or public roadways.
- Local ordinances that restrict construction activities during specific times or conditions.
- Lack of space for a staging or lay-down area.

Learning about some constraints is a result of the education that comes from the study of the contract documents, lessons-learned meeting with the estimating department, and possibly knowledge of local practice or ordinances.

Determine Potential Problem Areas

A natural extension of understanding project constraints is to look for areas that can pose a potential problem or delay. Every project has critical areas that can create a “bottleneck.” These bottlenecks are identified by using the combined past experience of the team. This is where the old saying, “an ounce of prevention is worth a pound of cure” really applies. Potential problem areas such as the connection to existing water or other utility services and existing elevations at pipe inverts are but a few. The column line where the new addition is attached is also a good start. Existing conditions are rarely if ever as they appear on as-builts. A simple investigation or verification before the work has to be done can often save thousands of dollars and many days. As stated previously, early investigation allows the project manager to pose more cost-effective solutions or hire specialists that can supply solutions that prevent crisis or delay. At the very least, the PM is aware of where the high-risk tasks are and can act to mitigate the risk.

Understand Contract Procedures

Each project has contract procedures that are unique to the project and/or the owner: everything from payment schedules to administrative

requirements. Others include insurance limits and indemnification clauses, inspection notification minimums, and updating intervals of the CPM schedule. Some less matter-of-fact procedures that the PM should understand include unfavorable contract language that assigns a disproportionate share of the risk to the contractor for specific events, no claim for delay clauses, time limits on claims notification, and dollar-driven CPM schedules that tie payment to performance. These are considerably less benign and should be in the forefront of the project manager's mind. While many of the contract procedures are identified in the Planning Process, they may not always filter down to the subcontractors and vendors. As these procedures apply to them as well, they should be aware of them and even built in to their agreements with the contractor.

Other more sophisticated procedures such as tax or energy credits/rebates by meeting certain predetermined objectives as having a project completed by a certain date can have far-reaching implications. All parties involved should be aware and held accountable in no uncertain terms.

The Schedule and Budget

As we will discover later in this text, two critical tools for project control are the schedule and the budget. Thus far, our focus has been on the schedule and its overall contribution to the project management process. It is the plan to accomplish the deliverables set against time. Equally as important is the budget. The budget is the dollars available to pay for the cost incurred as a result of performing the work to achieve the deliverables. The budget is a modified version of the estimate. It is the value of the work as seen through the eyes of the estimator, divided into elements that can be used to track cost in the performance of the work. Sometimes these costs are in the original categories in the estimate. Sometimes they are combined in *Work Breakdown Structures* or WBSs that represent the scope of a subcontractor's work. For each WBS there is a *Cost Breakdown Structure* or CBS that is the corresponding dollar amount available in the budget to pay for the work.

The schedule and the estimate are distinctly different but profoundly interrelated. It is the integration of schedule and budget that creates the baseline or performance metrics so critical to project control. These two topics are so important that entire chapters have been dedicated to each.

Summary and Key Points

This chapter reviewed the basic concept of project management with special focus on its application to the construction industry, also including a brief history of project management as a basis of project control and the

contribution of two of its early practitioners. This chapter introduced the reader to several approaches to project management but highlighted the most common methodology and its five steps or processes: initiating, planning, executing, monitoring and controlling, and closing.

The benefits of proper planning are significant and provide an in-depth education on the project itself. As the lead on the project team, the project manager plays a role in the project management process that cannot be overstated. It is the project manager's duty to advance the goals of the project team.

Chapter 1 also explained the roles of the contract documents—plans, specifications, and addenda—in the project management process. It is one of the most important tools the project manager uses to manage.

The schedule and the budget are two critical components that create the baseline for project control.

Key points of this chapter are:

- Project management is the practice of planning, executing, monitoring and controlling, the work for a construction project.
- Project control is a subset of project management that focuses on cost and schedule as a means of determining performance.
- The traditional approach to project management often is the best methodology for construction projects due to its linear execution of tasks.
- The project manager is the team lead, often overseeing the development of both the schedule and the budget to be used as performance metrics.
- The project manager must understand his or her role and the contract documents. They must communicate this information in the development of the plan and the schedule.

Chapter 1 The Basics: Questions for Review

1. Name the two key principles described in Gantt's 1919 book, *Organizing for Work*.
2. Gantt was one of the first to recognize that in order for a team of workers to produce efficiently and to maintainable standards, what was required?
3. Fayol's book, *General and Industrial Management*, published in 1916, outlined a flexible theory of management that could be applied to most industries. What was the theme of the book?
4. Gantt is recognized for what visual tool which measures actual progress against planned progress?

- 5.** Name the six management functions that Fayol is credited with that are still the basis of project management today.
- 6.** Identify the five steps in the traditional approach to project management.
- 7.** Name the five approaches to managing projects.
- 8.** What is the most tangible benefit of the pre-construction Planning Process?
- 9.** Define the components of the Monitoring and Controlling Process.
- 10.** Explain the role of the contract documents in the control process.

