Chapter **1**

Introduction to Project Planning

Construction Project Scheduling and Control, Fifth Edition. Saleh Mubarak.

Companion website: www.wiley.com/go/Mubarak/constructionproject5e

INTRODUCTION

Planning is a comprehensive and generic term that is used frequently by individuals, groups, organizations, and governments. People make planning, formal or informal, for almost everything from a small task like a dinner party or going on a picnic to a large matter such as building a spaceship to land on another planet. *Planning* has been defined in different phrases with the same core meaning. The Project Management Institute (PMI) defines a *plan* as "a proposed means of accomplishing something," thus, *planning* is the "process of preparing the plan to accomplish the objective."

Project planning is no different, but it is focused within the context of the project: its scope and constraints. *Project planning* was defined as "the process of choosing the one method and order of work to be adopted for a project from all the various ways and sequences in which it could be done" (Antill and Woodhead, 1990, p. 8; Callahan, Quackenbush, and Rowings, 1992, p. 2). The author defines *project planning* as "the comprehensive process of *thinking of* and *preparing for* all activities and actions needed to successfully complete a project." The key terms in this definition are *thinking of* and *preparing for* which are the basic two legs of planning: thinking of all the requirements and preparing all the needed resources to achieve the objective as efficiently as possible. The term *successfully* in the definition implies completion of the project within the set constraints, such as budget and schedule.

The AACE International defines *planning* as the determination of a project's objectives with identification of the activities to be performed, methods and resources (cost, hours, time, materials, etc.) to be used for accomplishing the tasks, assessment of both value and risks, assignment of responsibility and accountability, and establishment of an integrated plan to achieve completion as required.[1]

Tip Box 1.1

Often, there is an inverse relationship between planning cost and effort, and the execution cost and effort. Proper planning saves cost, time, and headaches.

Project planning serves as a foundation for several related functions such as cost estimating, scheduling, procurement, cash flow predictions, quality management, safety management, risk management, project control, logistics, and more.

WHO MUST PLAN?

The purpose of project planning is to proactively develop an approach to achieve project objectives (deliverables) in the most efficient manner. Planning is required

[1] AACE International Recommended Practice No. 10S-90, Cost Engineering Terminology, TCM Framework: General Reference, Rev. May 27, 2021.

from all project participants, but the type and nature of this planning depend on the specific party's role, responsibility, and timing (when the assignment is anticipated and known):

- The owner is the first party to be involved in the project even before its inception. Project planning helps the owner:
  1. Make the decision whether or not to carry out the project unless this project is mandatory. This includes but is not limited to defining scope and constraints, performing feasibility studies (financial, legal, and other), and comparing alternative designs and execution methods, and
  2. In better and more efficient execution of the project, including choosing the most appropriate type of contract and delivery method.
- Project planning helps the designer (architect/engineer) in aligning the project design with the owner's objectives and constraints as well as legal and professional requirements.
- Project planning helps the general contractor in better and more efficient management of the project: fulfilling the contract requirements and maximizing its profitability.
- Project planning helps subcontractors in starting their involvement in the project with the right foot, with full understanding of their roles and responsibilities, fulfilling their contract requirements and maximizing their profitability.

In general, the earlier the planning is performed, the better the expected results will be, as shown in Figure 1.1.

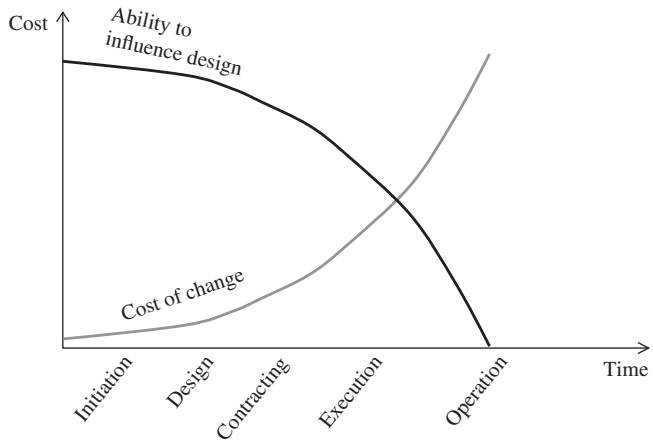

Figure 1.1 Importance of early planning.

Tip Box 1.2

Failing to plan is planning to fail!

Tip Box 1.3

Those who say "I don't have time for planning" are likely to need planning badly!

WHAT IS A PROJECT?

We have already defined *project planning*, but we need to define a *project*. The PMI defines a *project* as "A temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a beginning and an end to the project work or a phase of the project work. Projects can stand alone or be part of a program or portfolio" (*PMBOK*, 7th ed., 2021). The key words in this definition are *temporary* and *unique*: any project must have a starting point and a finishing point. It also must have a deliverable product, service, or result that is unique. Here are examples on each type of project's deliverables:

A. A building or a road is a project with a product as a deliverable.
B. Transporting goods between two cities is a project with a service as a deliverable.
C. An improvement of the average students' SAT scores in a school or district is a project with a result as a deliverable.

However, in all three preceding examples, the scope and major constraints, such as the budget and timeframe, must be defined in order to qualify as a project. For example:

A. The building project has a design and specifications, a budget of $16 million, and a timeframe of 14 months.
B. The goods transportation has a clear scope, a budget, and a timeframe.
C. The improvement of the average students' SAT scores must be defined, for example, from the current level of 950–1,050, within a certain budget and timeframe.

The budget and timeframe for the preceding and other projects may be approximate, subject to several factors, and based on available information, but having such constraints is a must for the work to be defined as a project. There could be more constraints: environmental, safety, and others.

Tip Box 1.4

Every project must have a starting point, a finishing point, and a deliverable.

Are Projects Unique?

Some people think of two or more projects as being identical just because they have the same design, and they look similar after completion. However, when we consider the construction process as the project, that is, how these projects were built, then every project is unique and there are no identical projects. Differences may occur because of location (soil type, weather conditions, labor market, building codes, unforeseen conditions, etc.), contract type, labor skill level, management type and experience, or for other circumstances (risks, safety issues, etc.).

For this reason, we deal with every project as a new and unique experience, although we utilize "lessons learned" from previous and similar projects. Note that similarity does not imply identicality. We may see identical items in different projects, but when we put all elements together, each project is unique.

Tip Box 1.5

There are no two identical construction projects. Some projects may look identical after completion, but the construction process they had was not identical.

Whose Project Is It?

Although we may be talking about the same physical project, such as a house, office building, or a school, the definition of a *project* differs among project participants, based on the role and responsibilities of each. For example, as shown in Figure 1.2, the owner's project starts from the moment the project is approved, although the project's proposal starts earlier. For the designer, the project starts when the contract with the owner is signed and ends with the delivery of the completed design. The general contractor's project starts when the contract with the owner is signed and ends at the final completion of the project and the handover to the owner.

Tip Box 1.6

Even though the final product: building, road, or other may be the same for all project participants, the definition of the project, in term or roles and responsibilities differs among project participants.

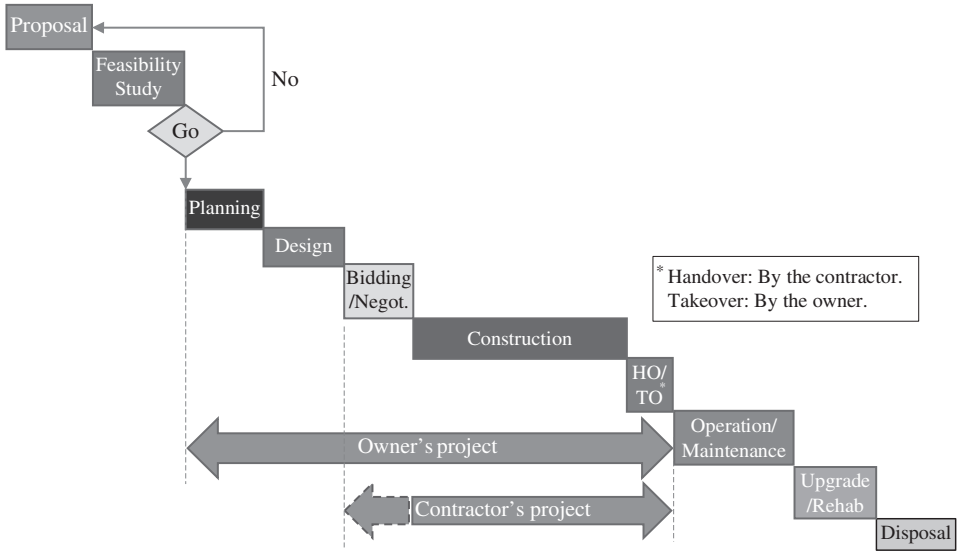

Figure 1.2 The project lifecycle.

THE PROJECT MANAGEMENT PLAN

The Project Management Plan is the document that describes how the project will be executed, monitored and controlled, and closed.[2] The plan:

- Is the outcome of the planning process.
- Represents the roadmap that shows how the contractor (or the party preparing the plan) intends to execute the project.
- Documents approved scope, schedule, and cost baselines, along with project planning assumptions, constraints, and alternatives.
- Is the point of reference for measuring progress.
- Guides project execution and control.

The plan has to be specific and dynamic at the same time. "Specific" so project parties know exactly what to do and where to go, along with who, how, how much, when, and other constraints. "Dynamic" means capable of responding to unexpected events and changes and has a mechanism and margin for adjustments, allowing the contractor to achieve the objective as efficiently as possible. It is like the GPS in our cell phones: The GPS gives you the best route to get to your destination, but an unexpected accident or incident may trigger a change to the route during the trip that allows you to reach your destination as soon as possible.

[2] *PMI-PMBOK*, 7th ed., 2021.

The plan can take different shapes and have different contents depending on the purpose of the plan, the information available, the timing of the plan, and the level of details needed. So, it is normal to start with an abstract plan that could be one page or less; outlining the scope of the project in a semi-defined way, along with major constraints. As time passes and more information becomes available, planning gets more detailed.

The term *planning* in some countries outside North America may have a different connotation. It is used in the context of scheduling, indicating the time management aspect of the project. Professionals whose job is to create and manage schedules, are given the title "planners" in these countries. The author is not taking sides here in terms of right versus wrong, but to put all readers of this book on the same page, we adopt the U.S. terminology for the terms *planning* and *scheduling*. Scheduling is discussed in the next chapter. Planning and scheduling are two different concepts and areas of project management. They overlap and interrelate, as explained in the next chapter, "Introduction to Project Scheduling."

Different organizations have different planning units and processes. It is very useful for the contractor, or his/her project manager, to lead this effort and do the planning with the help of other team members, each based on his/her own specialty. This can also be done by conducting planning sessions. Such meetings will continue throughout the project execution phase, maybe in parallel with other periodical meetings such as risk management.

The Project Management Plan must not be abbreviated as PMP, as this acronym is reserved for the PMI's PMP, project management professional, certification.

Tip Box 1.7

The Project Management Plan is the document that describes how the project will be executed, monitored and controlled, and closed. It is the roadmap that shows how the contractor intends to execute the project.

PROGRAMS AND PORTFOLIOS

After defining and discussing projects, let us define two other related entities: programs and portfolios.

A *program* may mean different things to different people, depending on the context. In project management, a program usually is a group of related projects and/or activities and services intended to meet a common objective and usually managed by one entity. A program can also indicate a large and complex project that is divided into several projects for more effective management. The PMI defines a *program* as "Related projects, subsidiary programs, and program activities that are managed in coordinated manner to obtain benefits not available from managing them individually" (*PMI-PMBOK*, 7th ed., 2021). Programs may include

elements of related work outside the scope of the discrete projects in the program. Here are some examples for programs:

1. The city government has a program to improve a section of its downtown area. This program includes projects for new buildings, residential and commercial, renovating other buildings, new roads/bridges, upgrading infrastructure, and more. They all serve one objective: improve that section of the downtown.
2. A government agency has a comprehensive solution for a traffic issue in a major city. This program includes new roads, bridges, tunnels, and other transportation/traffic systems. It also includes sidewalks, a parking garage, and hardscape. They all serve one objective: solve the chronic traffic problems in that area.
3. A city is hosting the Summer Olympic Games in about 7 or 8 years. It plans to build new stadiums, renovate other stadiums, build and renovate several buildings, and improve the transportation/traffic and infrastructure systems. They all serve one objective: hold a successful Summer Olympic game.
4. A developer is planning a large development that includes a midrise apartment building, 60 townhouses (10 buildings of 6 units each), clubhouse complex, including a swimming pool and playground, commercial building (supermarket and retail stores), and all the roads and infrastructure needed to serve the development. They all serve one objective: build an integrated modern development.

Programs, like projects, are temporary by nature. They have a starting point and a finishing point. However, many government and private organizations have an ongoing/perpetual unit called program, such as public works, road maintenance, and stormwater programs. These "programs" usually have an annual budget as well as a list of projects, with different costs and priorities, that need to be performed. In almost all cases, the cost of these projects exceeds the available budget, so the leadership prioritizes them and selects a group of them to be performed this year, fiscal or calendar. The rest of the projects are either postponed or canceled. If we imagine a conventional program as a box with many components (projects) inside, the "perpetual program" will then look like a conveyor belt: loading proposed projects and budget at its start and unloading finished projects at its end. A one-year snapshot of this conveyor belt will be a conventional program. The perpetual program can be more accurately called a department.

Another term we need to mention is the *portfolio*, which relates to both the project and the program. A *portfolio* is a collection of projects, programs, and other work that is grouped together to facilitate the effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily

be interdependent or directly related (PMI-PMBOK, 7th ed., 2021). Here are some examples for a portfolio:

- A construction company has a portfolio for "city work" where all projects and other works with the city government are grouped together.
- A construction company may combine all projects in a certain geographic region into one portfolio.
- An organization, public or private, may group projects with high risk into one portfolio.

Figures 1.3 and 1.4 explain the terms discussed earlier and the relationships among them.

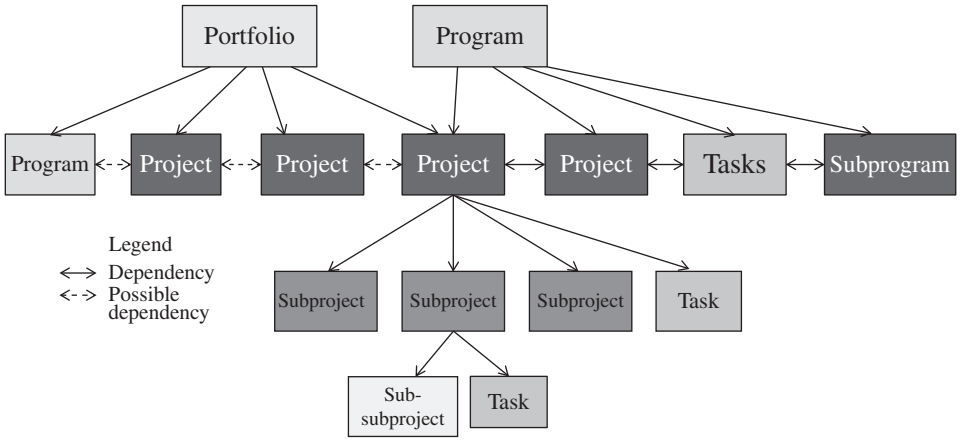

Figure 1.3 Programs, portfolios, and projects.

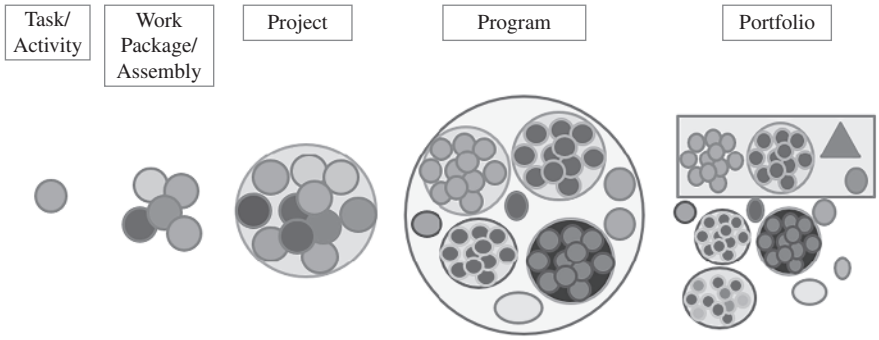

Figure 1.4 Activities, programs, portfolios, and projects.

Tip Box 1.8

A program can be a complex that includes several projects and other activities, but they all must be intended to meet a common objective and usually managed by one entity.

In the case of a portfolio, it also includes several pieces of work, programs, projects, and activities, but they don't have to be related. They are combined into a portfolio to help the organization's management meet strategic business objectives.

COMPONENTS OF A PROJECT

There are a few components of a project or program that we need to define: subprojects, work packages or assemblies, activities, and events.

An *activity* (also called a *task*) is a component of the project, which serves as a basic unit of work as part of the total project that is easily measured and controlled. It is time- and resource-consuming. This activity can be small such as stripping a column formwork or plumbing a vertical member, or as large as excavating 50,000 cubic yards of soil. However, for practical purposes, we like to limit the activity size to a reasonable range. Activities within a project are usually defined by breaking down the project into homogeneous components, depending on several factors that will also be discussed later.

Even though we look at the activity as the smallest component in the construction project, sometimes we may even divide the activity into smaller components called steps that help distribute the cost or resources over the duration of the activity in different ways.

An *event* is a point in time, representing the start or finish of an activity. Important events are called *milestones*. In some cases, an activity with a very short duration, such as inspection or approval, may be considered as an event.

Tip Box 1.9

On a timescale, an activity is a line while an event is a dot. This is because the activity has duration >0 while the even has 0 duration.

For example, the activity can be mowing your lawn. The event may be finishing the mowing.

A *work package* or *assembly* is simply a collection of related items or activities within a bigger scope of work (usually the project). The work package includes items assembled to form more comprehensive items to facilitate and speed up the construction process. It can be as small as a simple partition assembly or as large and complex as a

3D building component. It can be assembled onsite or delivered to the construction site pre-assembled. Compared to the auto industry, we can look at the finished automobile as the project, and the components such as upholstery, suspension systems, and the engine as assemblies.

Subprojects are another concept that we need to define. *Subprojects* are segments of the original project that are divided according to specialty, responsibility, phase, area, or other criteria. To the person in charge of a subproject, the subproject is a project, except that the person has to consider not only the internal relationships among the activities, but the external relationships as well (with activities in other subprojects within the entire project). For example, in a residential or commercial development project, building the infrastructure may be regarded as a subproject. In fact, building the sewer system in the development can be a subproject (to the entire development project) or even a sub-subproject (to the infrastructure subproject).

Unlike projects, programs, and portfolios, a subproject cannot be a standalone piece of work, regardless of its size. A subproject does not terminate in a final product (deliverable) but will complement it along with other subprojects and activities within the project.

Tip Box 1.10

The assembly or work package is a collection of related items or activities within a bigger scope of the project. It usually involves several tradespeople who work on different components of the assembly. It can be delivered to the site pre-assembled or be assembled onsite.

Tip Box 1.11

A subproject is a segment of the original project that is divided according to specialty, responsibility, phase, area, or other criteria. A subproject cannot be a standalone piece of work, regardless of its size.

Where to Draw the Line?

In many cases, the line between an activity and an assembly, an assembly and a project, or even between an activity and a project, is subjective and not so clear. Many chunks of work can be classified as an activity, assembly, or a project, depending on the overall context and the user's preference. For example, building a concrete block wall around a building can be considered an activity, subproject, or a project, depending on the situation. Converting a garage into an office or replacing the carpet in a house may be considered an activity or a project.

In almost everything we do, we can break down the work based on the nature (specialty) of work, location, phase, or size. The independence of the work item can make a difference in labeling it. For example, in the "Building a concrete block wall" example earlier; if it is part of a bigger work assignment (project), then it can be an activity or work package.[3] Even when it is part of a bigger project, it can be considered as a project to the subcontractor building it. If it is an independent work assignment, it can be considered a project.

All these work components have one thing in common: their temporary nature (start through finish). If any of them becomes routine (repetitive regularly), it will then become part of operations management, which is different from project management.

PLANNING PROGRESSION WITH THE PROJECT LIFECYCLE

Planning costs money but it is considered an investment as it is expected to save money and time and improve execution overall. But what if we perform planning for a project or event that never happened? Is it considered a loss? Not necessarily, because we need to also consider the other case if the project or event happens with no planning. For this reason, planning may and does get performed in stages: With every stage, more information is obtained, which allows the planner to proceed with more elaborate steps or abandon the work. The objective is to attain the highest benefit/cost ratio.

Planning may begin prior to project authorization but intensifies gradually, especially after the official authorization. In general, the project team, belonging to any party, progressively elaborates/receives project information, such as a vision statement, project charter, schematic design, and other project requirements, to identify and define the path to achieve the desired outcomes. When the planning party is unsure if the project will exist or if they will have a contract, it needs to be careful with regards to the planning effort and its cost, keeping in mind the odds of winning the project. However, once the project is confirmed, the party proceeds with full-fledged planning. For the owner, this point is when the project is officially confirmed. To the general contractor, it is the point when the contract is signed.

As an example, let us consider Figure 1.5 with both its components. The upper graph describes the project's stages, from preconception to completion. The lower graph displays planning effort/cost versus time.

1. Prospective project: The contractor receives a tip that a project may be available through bidding or negotiation. The contractor may do a quick and superficial investigation on the project.
2. Invitation to bidding: The project is announced via an invitation to bid or negotiate. So, the project exists but the contractor is not sure if he/she will

[3] We can think of it as a work package having several related items such as reinforced concrete wall footing, concrete block wall, stucco, and paint.

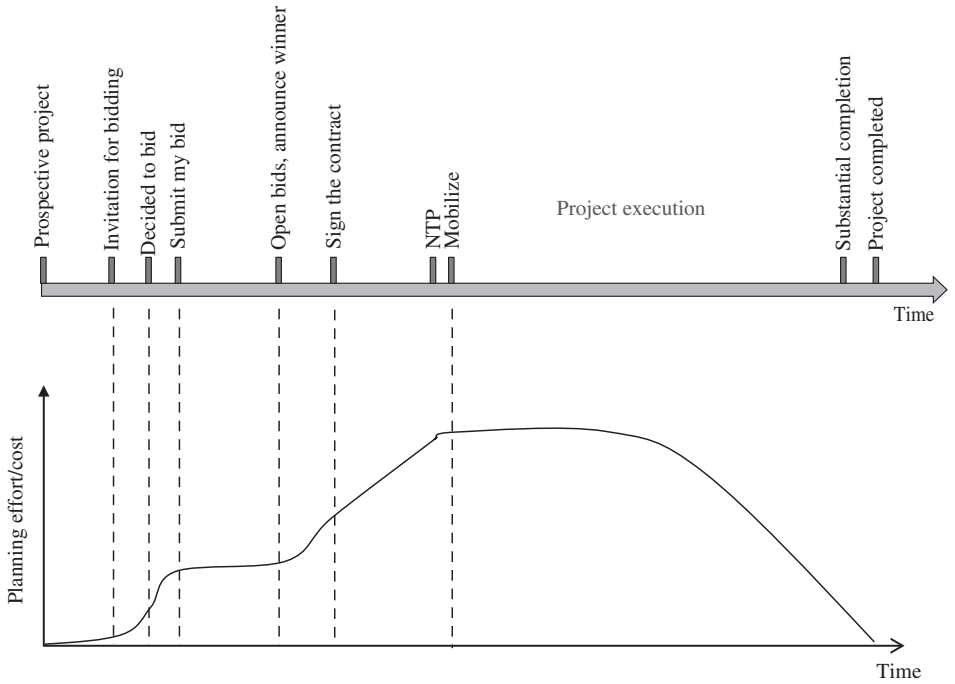

Figure 1.5 Project planning through the stages of the project.

sign a contract. This situation may require a little more investigation to allow the contractor to decide, such as preparing a cost estimate and a schedule. A visit to the site may be necessary, depending on the project location.

3. Decision to bid: The contractor decides to bid and prepares a detailed cost estimate and schedule, which require considerable effort. The contractor submits a bid or an offer in the case of a negotiated contract. After that, the contractor will likely decrease or even stop the planning effort, awaiting the bidding results.

4. Opening the bids and announcing the winner: The contractor's bid or offer was successful, and they sign the contract. The period between the bid opening/winner announcement and signing the contract is a period of high certainty for the contractor, but still not 100% secured. Once the contract is signed, the contractor can be confident of the "ownership" of the project.

   The period between the winner announcement, or particularly, signing the contract, and receiving the notice to proceed (NTP) is very valuable to the contractor's planning because the project is secured but the time does not count against the contractor until the NTP is issued. Many details will be investigated and planned during this stage such as site planning and procurement.

5. NTP issuance and mobilization: Now the project execution starts. The planning effort continues in parallel with the work on the ground. Around the middle of the project, planning starts to wane down.
6. Substantial and final completion: Planning practically ends with the end of the project, but there might be a little jump in the last part of the project due to the preparation for the final completion and the project close out.

In general, the planning effort, both up front and throughout the project, should be determined by:

- Information available,
- Purpose of the planning, and
- Expected benefit[4] or benefit/cost ratio.

Figure 1.6 shows the general relationship among planning, information available, and project execution.

Tip Box 1.12

Proper and timely planning can be a great investment, resulting in saving money, time, and headaches.

As an example, the contractor may start with a brief Project Management Plan when considering bidding on the project, as in Figure 1.5. This plan has a brief description of the project, its location, approximate cost and timeline, and some general notes. After the contractor secures the project, the plan expands to include a detailed description of the project, list of subcontractors, detailed cost estimate, detailed schedule, resource requirements, cash flow diagram, quality management plan, risk management plan, safety and logistics management plan, any additional constraints, and more.

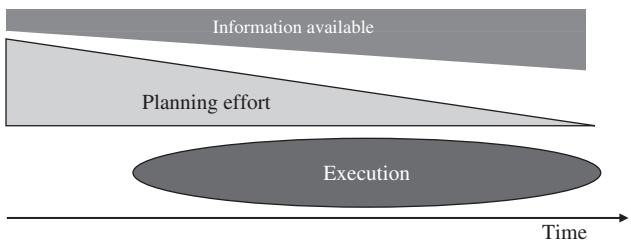

Figure 1.6 The relationship among planning, information available, and project execution.

[4] The term *expected* combines the value and the likelihood.

Project Planning and Site Liability

We mentioned earlier the importance of visiting and inspecting the site by the contractor. The contractor may need to visit the site several times, based on the stage of the project. In each visit, the contractor explores and collects more information. The contractor may do his/her own geotechnical investigation, utilities locations, and general observations. Utilizing drones, especially for viewing hard-to-reach areas, and videotape observations, may be a good idea. The contractor must keep a record of anything that may have an impact on the project objective or constraints. This issue is important from a legal and professional perspective. Typically, the owner provides the contractor with site information such as site map, soil/geotechnical report, utilities locations, and others. It is possible that things on the ground may not match information provided by the owner. This can be attributed to errors or omissions in the drawings or that drawings are old and may not be up to date.

This is why the contractor's visit to the site and the inspection is important. In the case when the contractor files a change order claim with the owner for differing site conditions, the general rule says that the contractor is responsible for anything on site that can be seen or detected easily (in a site visit) such as a utility pole or old cottage that must be removed even if the information provided by the owner does not show it. However, if the differing site conditions are underground or cannot easily be discovered, then the change order may be justified. This matter is not completely settled as owners and contractors try to add or modify contracts terms to shift the liability to the other side, but the general rule mentioned earlier is still highly applicable.

The PMI Project Management Process Groups

The PMI defines the *Project Management Process Group* as "a logical grouping of project management inputs, tools and techniques, and outputs." The process groups are initiating, planning, executing, monitoring, and closing, as shown in Figure 1.7. Typically, the owner is responsible for the initiation phase, with or without the use of external consultants and other professionals. The planning phase in the PMI's definition, which includes the design for construction projects, is aimed at defining

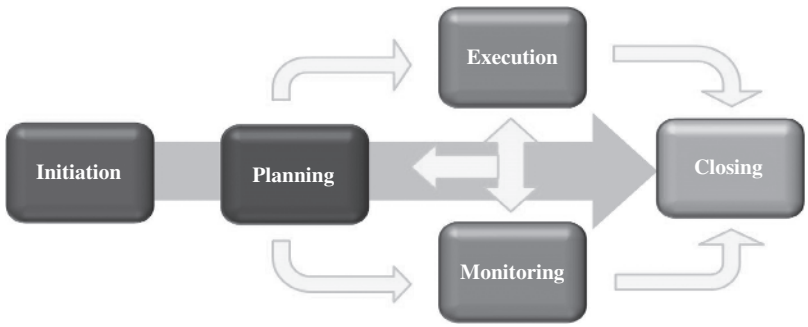

Figure 1.7 Project Management Process Groups.

the project in more detail. Next is the execution, which is the general contractor's responsibility, and the monitoring in parallel, which is the owner's responsibility. Finally comes the closing process that combines aspects of physical work, legal, and financial.

Perhaps this categorization of planning applies to activities and projects of short duration: plan and then execute. However, the author believes that it does not accurately apply to construction projects that take months or years to complete. Even though the bulk of the planning effort is conducted before the start of the project execution, planning continues alongside the execution as explained earlier and illustrated in Figures 1.5 and 1.6.

Tip Box 1.13

In construction projects, especially large ones, the bulk of planning must be conducted before the start of execution, but it continues throughout the execution, making needed adjustments to the plan due to changes in requirements and other factors impacting the project.

Planning During the Construction Phase

As shown in Figure 1.6, planning continues during the construction execution phase. However, as planning, by definition, is focused on future work, the planning effort will gradually decrease with the decrease of the remaining amount of work. The plan must be updated periodically through the execution phase with items taken out of the plan (completed or canceled), adjusted, or added to the plan. Such updates must be coordinated with other project functions such as project controls, risk management, procurement, cash flow, and other areas.

The Contractor's Organization's Strategic Planning

The contractor, or the leadership of any organization, needs to plan not only at the individual project level, but also at the entire organization level, both in the short and long term. This includes balancing risks, resources, cash flow, and other aspects. It includes any future plans or needs for expansion and adjustments, along with contingency and alternate plans to suit any market changes.

Planning at the organizational strategic level includes items such as:

1. Management of resources, particularly staff and major equipment, among closing, ongoing, and upcoming projects. This includes acquisition of new sources, layoffs, and disposal.
2. Management of cash flow at the corporate level.

3. Management of projects risk at the corporate level.
4. Plans for expansion to new regions.
5. Plans to take on new types/specialties of projects.
6. Contingency plans for a fluctuating economy.
7. Plans for implementing new technologies.
8. Office management for lean and efficient operations.
9. Any other plans for increasing the strength and profitability of the company.

Such plans must be reviewed, updated, and adjusted periodically, based on changes in the market, leadership, or other factors.

CHAPTER 1 EXERCISES

1. Define *project planning.*
2. Every project participant needs to plan. Explain this sentence and how the planning of each project differs.
3. Project planning helps the owner with two important issues. What are they?
4. *What is a project*? What makes planning construction projects different from general planning? (*Hint*: think of the key words in the definition of *project.*)
5. Are the following projects? If not, make modifications that would qualify them as projects:
   a. Repair of a broken diesel generator
   b. Raising my two kids to be the best people they can be
   c. Cooking daily for my family
   d. Preparing for my son's wedding
   e. Investing in the stock market
   f. Periodically backing up the data on an external media or the cloud
   g. Converting my garage to a playroom
6. A restaurant franchise wants to build new restaurants with identical design in five cities. From a construction perspective, are these identical projects? Explain.
7. What is a *Project Management Plan*? Give an example.
8. How can you label a work assignment: as an activity, work package, or a project? What are the factors that you consider?
9. Think of a construction project in which you participated or you observed. Write down the steps involved in its planning (without much specificity).
10. Define *portfolio* and *program* in the context of project management. Give examples of each.

11. Meet with a project manager for a construction project. Inquire about the steps they take for planning the project execution.
12. Planning for a general contractor takes different forms, with different objectives, different depth, and varying effort and cost, depending on the phase. Discuss in detail.
13. For a construction project planning, discuss the relationship among information available, planning effort, and the execution.
14. What are the differences between planning a construction project (for a general contractor) and planning to buy a house?