

Project Management



Facility managers play a crucial role in project management, handling tasks from planning to evaluation. These skills are vital due to the diverse nature of projects in the facility organization, varying in scope and complexity. Facility managers organize, delegate, and monitor projects, ensuring alignment with the organizations and customers interests throughout the project life cycle.



Project Management

✦ Introduction

Role of facility managers as related to *Project Management* competency

According to the IFMA global job task analysis:

Facility managers play a major role on all aspects of project management beginning with planning, scoping, [and] scheduling and ending with evaluating. Project planning and management are core skills in facility management. The skills are particularly important because of the wide range of projects assigned to the facility organization. Projects vary in scope, complexity, duration and financial risk.

Facility managers' project roles involve planning, organizing, delegating, monitoring and controlling projects and ensuring that the interests of the FM organization and its customers are represented throughout the life cycle of a project. However, a facility manager's role may vary depending on the specifics of the project and his or her capabilities and availability. Common roles for facility managers include:

- Being the project manager.
- Delegating work to a project manager and being accountable for results.
- Being a team member on the project (e.g., a different business unit's project or a project for the entire organization).

This summary contains information on what makes a good project manager and how facility managers determine their optimal role on a given project.

The ability of the facility manager to accurately estimate project costs, produce a feasible and properly organized project budget and keep a project on budget strongly affect the facility manager's credibility with senior executives or clients and his or her ability to get funding for future facility projects.

Benefits of understanding project management

How can an understanding of projects and project management increase the capabilities of facility managers and FM staff? The following are examples of FM organization successes that can be achieved by applying a project format and sound project management skills:

- Effectively managing a move or relocation can minimize organizational downtime and lost productivity and maximize profits (or avoid costs).
- Successful project management of MAC (move/add/changes) projects can lead to improved customer satisfaction.



- Facility managers can have a significant impact on the organization's bottom line because a large amount of funds are invested in capital renewal projects that are overseen or managed by facility managers.
- Sustainability and energy conservation projects can significantly reduce costs and energy consumption.
- Careful and thoughtful completion of code-/safety-related projects can have a significant impact on the health and welfare of customers and building occupants.
- Well-managed manufacturing industry or laboratory and research projects can maximize profits and minimize production downtime.

Furthermore, an understanding of projects and project management will help not only the project manager but also FM staff who join a project team so that they can understand the overall purpose of the project and contribute to that purpose.

Rationale for use of planning in project management

Planning allows the necessary decisions for a project to be considered in advance. Project managers prioritize objectives and specify the what, why, who, how, where, and when for the project to understand resource availability and other constraints. Project managers benefit from planning because it helps them make difficult decisions by design rather than by default. Planning also creates a baseline for directing, measuring and controlling project progress, helps determine and compensate for risks, and helps deliver consistent communications. The sum of these benefits forms the primary rationale for planning: Without planning, the probability of project failure is quite high. Numerous studies on projects document that rework, project overruns and even project cancellations are common and cut across many industries, including engineering and construction. While the statistics themselves are best researched online, project managers should understand that the risks of failure are significant.

The most frequent lesson learned from inefficient, ineffective or cancelled projects is that the project was inadequately defined or planned. The projects fail from the start but often consume many resources before being declared a failure.

Without an adequate definition of the problem to be solved and a plan to solve the problem, projects can experience scope creep. Scope creep is an extension of the objectives of the project by external influences, resulting in undesirable and unplanned changes to a project's scope or constraints of time, cost and quality. Scope creep ultimately results in missed budgets, missed deadlines, and/or unnecessary features. There will inevitably be changes, and the plan



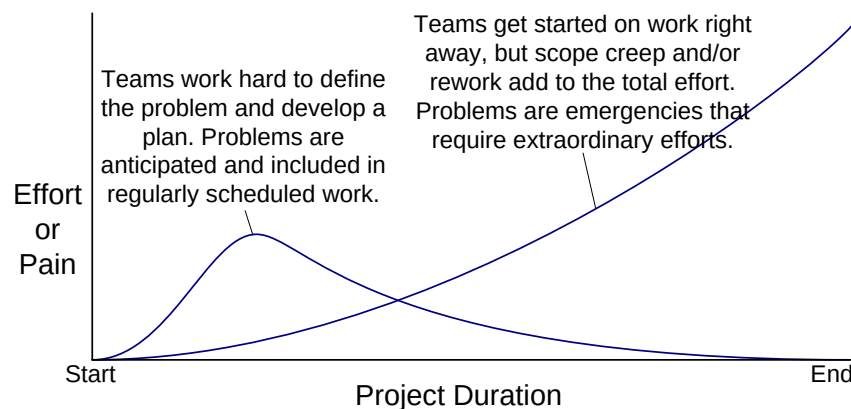
should accommodate useful change to support the project objectives. However, scope creep occurs when unnecessary changes are incorporated due to lack of appropriate change control on the part of the project manager.

Project managers can determine the difference between desirable and undesirable change using the following criteria:

- Does the change address the problem as originally defined? If not, defer.
- Does the change more closely align the project with the original plan? If it clarifies, completes or corrects, then accept. If not, reject.

Without an adequate problem definition and plan, it becomes difficult for a project manager to answer these questions and the result of any change becomes uncertain. Exhibit 4-30 shows how increased effort or “pain” up front can result in less total pain in the long run.

Exhibit 4-30: Adequate Planning Can Reduce Total Project Effort or “Pain”



Common reasons for project failure

There are many reasons why projects fail. The following is a list of some common reasons for project failure:

- The project is a solution in search of a problem.
- Only the project team is interested in the end result.
- No one is in charge.
- The project plan lacks structure.
- The project plan lacks detail.
- The project is underbudgeted or underfunded.
- Insufficient human or equipment resources are allocated to the project.
- The project is not tracked against its plan.
- The project team is not communicating.
- The project strays from its original goals (scope creep).



Scope of planning tasks

While this competency addresses all types of projects, from one-day equipment replacement projects to capital construction projects, in general the level of planning described is for projects between these extremes. Facility managers reduce or expand the scope of project management tasks to suit the needs of the project.

Overview of Project Management competency

Exhibit 4-31 describes the content covered in the following chapters.

Exhibit 4-31: Overview of Project Management Competency

Chapter	Content
1. Introduction to Project Management	• Role of projects in facility management organizations • Project manager role • Project management processes and models • Typical FM project format
2. Define Projects	• Project purpose and criteria • Project inputs • How to determine user requirements and produce a statement of requirements • Project charter • Statement of objectives
3. Plan Projects	• Basic steps in design/engineering of deliverables or space • Project management plan • Work breakdown structure/task list, project schedule, cost estimates and budgets, quality management plan, communications management plan, risk management plan • Project team and resources; specifications • Procurement management plan • Contract details
4. Manage and Oversee Projects	• Selecting internal staff and acquiring contracted resources • Tender/bidding contracts and proposal responses • Integrating/coordinating work of project team members • Executing and controlling project activities • Minimizing midproject change
5. Close Projects	• Verifying completion • Final deliverable reviews • Inspection/validation process • Certificates of occupancy, commissioning and occupying space • Contract closure process • Closing projects • Collecting, evaluating and presenting data on project outcomes



Chapter 1: Introduction to Project Management

After completing this chapter, students will be able to:

- Understand the role of projects in facility management organizations.
 - Appreciate the value of project management in planning, organizing, delegating, monitoring and controlling projects and in ensuring that the interests of the FM organization and its customers are represented.
 - Determine the requirements for a facility manager acting as project manager or for a potential delegate to this role.
 - Assess other factors to decide whether the facility manager should adopt or delegate the project manager role for a given FM project.
 - Comprehend project management processes and models.
 - Relate project management processes and models to a typical FM project format.
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✦ Topic 1: Facility Management Projects and Project Management

What are projects?

Projects can be defined in many ways. Quality guru Joseph Juran defines a project as “a problem scheduled for solution.” The IFMA definition of projects is more detailed:

Projects are specific units of work that when completed produce an outcome or achieve an objective. They can be abstract [in subject matter], like forecasting future facility needs or tangible, like renovations, new construction and demolitions.

Organizations will have their own criteria for what constitutes a project. For example, an organization could define forecasting future facility needs as a finite programming project, a component of a larger project or a regular (nonproject) FM activity.

Project attributes

Projects can also be defined by their common attributes. Projects are:

- Finite, meaning that they always have a beginning and an end.
- Complex processes that have numerous, sequenced tasks.
- Unique, meaning that they are a one-time set of events.
- Goal-oriented, meaning that they are designed to achieve specific objectives.
- Limited in scope, time, resources and budget.



- Team-oriented tasks in which members of teams often cross functional areas.
- Made up of temporary teams that usually disband at project completion.
- Required to produce one or more deliverables (end product or service).

Project criteria

FM organizations generally have policies, procedures and practices to define what is/is not considered a project, though there is often some overlap or leeway allowed in this decision. While some FM activities can only be accomplished as a project, other tasks can be handled either as a project or as regular FM activities. Examples of criteria for treating work as a project are:

- The work requires significant design and planning.
- The work exceeds a particular monetary value for a given type of task.

Activities that are usually treated as projects include relocations, design and construction, fit-outs, repair and renovation work above a particular complexity or cost level, and annual discretionary activities. Regular FM activities that are not usually treated as projects include operations such as cleaning or security services, maintenance such as preventive maintenance schedules, leasing and administration.

It is important not to treat all regular FM activities as project work because if all work is considered a series of projects, it tends to lead to a short-term mindset and project results could conflict with one another, for example, repainting a wall that will be demolished soon.

Reasons FM projects may be initiated

Facility management projects may be initiated to:

- Implement elements of the strategic facilities plan and/or master plan.
- Implement tactical plans that exceed a cost or work limit for regular operations and maintenance.
- Act in response to a mandate from a project sponsor (client or senior executive) accompanied by a release of capital funds.
- Resolve problems or implement performance improvements.
- Address the results of programming (i.e., a statement of requirements).
- Implement planned changes, for example, compliance with a code, regulatory or legal requirement; changes to existing organizational structure, staffing or systems; or facility renewal needs.
- Respond to unplanned changes, for example, unscheduled lease termination, unoccupied space becomes leased, merger or acquisition, organizational change such as rapid growth or downsizing, or emergencies such as sudden requirements from senior management, equipment failures or natural disasters.



Common types of FM projects

The different types of projects that facility managers may need to lead or be involved in include:

- Forecasting future facility needs (i.e., programming project).
- Facilities audits.
- New construction projects.
- Renovation, addition and/or alteration projects.
- Major equipment replacements.
- Churn projects (e.g., minor relocations).
- Major relocation projects.
- Organizational change management projects.
- Interior programming and space planning projects.
- Procurement of goods or services.
- Demolitions.

The nature of some of these projects requires external expertise, while other types of projects could be done either internally or externally.

The type of project may also be defined by whether it is funded using capital funds or operational funds. Minor projects are frequently funded using operational funds directly from the department being supplied the service (or as a chargeback). Major projects such as those for construction require release of capital funds, which are funds retained or raised for strategic business development needs.

Given an understanding of some common facility management projects, the next important concept is what is needed to manage these projects.

What is project management?

Like projects, project management has many definitions. The IFMA definition of project management states that:

Project management is the coordination of people, funds and resources, tasks, and approvals required to accomplish an objective. It includes developing project plans and providing oversight in their execution to assure resources are used as planned, timelines are met, and the desired outcomes are achieved.

Project management can also be thought of as an organized process for increasing the chances of project success. This process generally has the following components:

- **Objectives.** Project management has a set of results to achieve as expressed through its scope and its constraints of cost, time and quality.
- **Management processes.** Project management follows a predetermined set of processes such as scheduling or budgeting and follows a project cycle



that encompasses planning, organizing, implementing and controlling. (Topic 3 of this chapter introduces processes and cycles.)

- **Levels.** Project management incorporates both strategic and tactical planning levels.

What else is project management? Project management is:

- The process of allocating necessary and sufficient resources at just the right time to achieve a specific purpose as quickly as possible.
- Distinct from regular FM activities but a subset of overall FM activities.
- Often clearly linked to executing strategy and may be the only way to achieve some strategic goals since the bulk of a facility manager's time is otherwise consumed by other FM activities and responsibilities.
- More than just the use of project scheduling tools.
- An application of soft skills such as communicating, understanding behavior and managing stakeholder relationships.
- Integrated with quality tools.
- Able to incorporate flexibility if planned for in advance rather than asked for while the project is under way.
- Applied change management (projects create change).

Systems perspective

A key element of project management is that it takes a big-picture view of a project, including project planning and the integration or coordination of plans from a systems perspective. Project management from a systems perspective addresses the project as a whole rather than thinking of each part separately. These terms can be defined as follows:

- **Project planning** is the process of organizing the tasks, resources and people required to accomplish a unit of work.
- **Plans** reflect the anticipated use of resources, timelines, and the sequence of tasks necessary to accomplish the goals of the project.
- **Integration or coordination** in relation to project management is the process of unifying the relatively independent project components that were divided for project planning purposes back into a seamless process.
- **Systems** are a set of interrelated, interdependent elements with behavioral patterns that interact with and affect the performance and behavior of the other elements.

By these definitions, a project is made up of a system of tasks and subtasks that interconnect to form a network. Project management involves using processes to convert these task and subtask inputs into outputs to produce a predetermined result.



Project management versus regular FM duties

For facility managers, project management is a subset of the full set of FM skills. When facility managers are managing regular FM activities such as operations and maintenance, they apply a broad range of general management tools and techniques. When acting as a project manager, facility managers narrow this focus to key tasks:

- Using scheduling to provide a high probability that a plan is realistic
- Ensuring that cost estimates are realistic
- Focusing on labor productivity and job costs
- Tracking permissions, materials and equipment (procurement management)
- Ensuring that stakeholders are satisfied with the direction of the project and the project deliverables

★ Topic 2: The Project Manager

Facility manager's role

The facility manager's role on a given project may be as the project manager, as a team member, or as the person accountable for project success who selects/hires/contracts and manages/supervises the project manager. This topic discusses the role of the project manager in general. As such, descriptions of the qualities of a good project manager may refer to qualities the facility manager should possess when acting in this role or to qualities a candidate should possess when the facility manager is responsible for choosing and supervising/managing a project manager.

Following the discussion of the role of project manager, the topic finishes by listing some factors facility managers use when deciding how best to fill the role of project manager (and project team roles) for an FM project.

Role of project manager

The project manager role involves establishing consensus on project objectives; achieving these objectives; establishing, managing and leading the project team; and integrating or coordinating the project management process throughout each of its phases. To fulfill this role successfully, the project manager should possess certain qualities.

First, the project manager role needs management authority, such as the ability to make purchases within certain constraints and the ability to hire, discipline and terminate employees or contractors who directly report to the project manager.

Second, the project manager role requires that the facility manager or candidate possess both theoretical knowledge and field experience. This knowledge and



experience needs to be in two areas: technical aspects of the project and project management processes and techniques. A project manager can come from either a formal education background and then gain experience, or he or she can work in a field and then get some formal training. The amount of experience or training is dependent on the project(s).

Facility managers can make a self-assessment of their own skills when determining whether they would make a good project manager for a given project. If facility managers are responsible for internally staffing, hiring or contracting out the project manager role, they review and customize their organization's project manager job description to reflect the specific project work to be done. In either case, the following skills are generally desired in the role of project manager.

- **Leadership and influence.** The role of project manager requires leadership and development of influence. Project managers take pride in ownership of the project and its mission. They apply principles of leadership and influence to develop a team. Depending on the situation and audience, project managers modify their leadership style, from being assertive, to applying facts and reason, to listening, to being persuasive. Project managers understand that the goal of influence is to inspire others to do the right things rather than to tell them what to do.
- **Experience and self-assessment.** Facility managers assess whether they or the candidates they are considering possess the requisite theoretical knowledge and field experience for a particular project through formal training in project management as a discipline and/or field experience in leading a number of projects.

Another key project management skill to assess is people skills. The ability to work well with others is a difficult skill to develop without certain inherent personality traits. Therefore, it is vital that facility managers or project manager candidates possess people skills and exhibit a trend of continual improvement in these soft skills.

Project managers must also dispassionately evaluate their own skills and performance abilities in order to ask for help when needed, admit to mistakes, learn from mistakes and successes of past projects, vary approaches to fit the personalities of team members and stakeholders, and revise approaches to identify the approach that works best for a given team.



- **Recruiting and organizing a team.** The role of project manager includes responsibility for recruiting and organizing the project team. To put together an efficient team requires the ability to assess the strengths and weaknesses of potential or assigned team members and organize staff/contractors to optimize teamwork and fill needed areas of expertise. For example, a project manager may ask a number- and detail-oriented logical thinker to work on an audit and assign an outgoing person who understands verbal and nonverbal cues as a department liaison.

Project managers recruit and organize the project team to represent key stakeholders. The following are examples of these stakeholders:

- Customers (the facility manager's client), including board of directors (e.g., project approval committee), management (e.g., a designated decision maker for issues that arise in regularly scheduled progress meetings), department heads (e.g., asking department heads affected by a move to communicate to their staff before, during and after the move), end users (e.g., input for programming requirements), and landlords (e.g., provider of construction allowance for leased facilities)
 - The facility manager if different from the project manager (e.g., final approver for changes and supervisor of big picture)
 - Project team members (e.g., staff from FM organization, accounting, IT/telecommunications/networking, purchasing or marketing departments)
 - General contractors and subcontractors (e.g., specialists)
 - Professional services that provide expertise (e.g., design firm)
- **Management.** The role of project manager is as a planning agent who integrates and coordinates the work of others. Effective project managers can delegate appropriately and avoid becoming a bottleneck by delaying the approval process unnecessarily or micromanaging team members.

Project managers treat controlling and directing work as a full-time job. Project managers who take on project tasks are at risk of failing to manage the project as a whole and track its many components. For example, a project manager may brilliantly accomplish a task but miss that a team member has added an unauthorized feature.

Project managers manage people with an understanding of what motivates their actions. For example, rather than simply accepting claims that team members are on schedule, project managers spot-check some details



because they understand that people who are behind schedule may report being on schedule because they think that they can make up the time.

Project managers understand that accurate measurement is a prerequisite to management. For example, if an item in a progress report stays at 95 percent complete despite the continued expenditure of effort, project managers may further break down how the task is reported so it can be better measured and thus managed.

- **Communication and problem solving.** The role of project manager includes being the primary liaison between the project team and the executive team. Therefore, effective project managers realize that regular, personalized communications and sensitivity to organizational culture are vital to maintaining productive relationships with customers, superiors, fellow managers and team members.

Project managers use written and oral communication and practice active listening. They apply multiple modes of communication to reinforce messages, including meetings, reports, project management software, e-mail, printed bulletins, conversations and interpretation of nonverbal cues.

Project managers negotiate with stakeholders on a daily basis both to resolve conflicts and to help decision makers make choices that balance the needs of all constituents.

Facility manager's role in FM projects

Facility managers who satisfy all of the skill and knowledge requirements discussed above may still choose to delegate the project management role to another individual for a particular FM project. For example, capital construction projects are generally fully delegated to a general contractor who supplies a project manager and separate project team. This project manager reports to the facility manager.

Facility managers must understand that when delegating work to others it is important not to interfere with the subordinate's authority and daily management work. The facility manager can (and often should) delegate responsibility and project management duties but cannot delegate control of FM projects. In other words, the facility manager can delegate responsibility but not accountability.



Note that there are times when a facility manager is not the accountable party for a project but is a team member on a project run by someone outside the FM organization, for example, a project initiated by the corporate real estate group if it is a branch of the executive department.

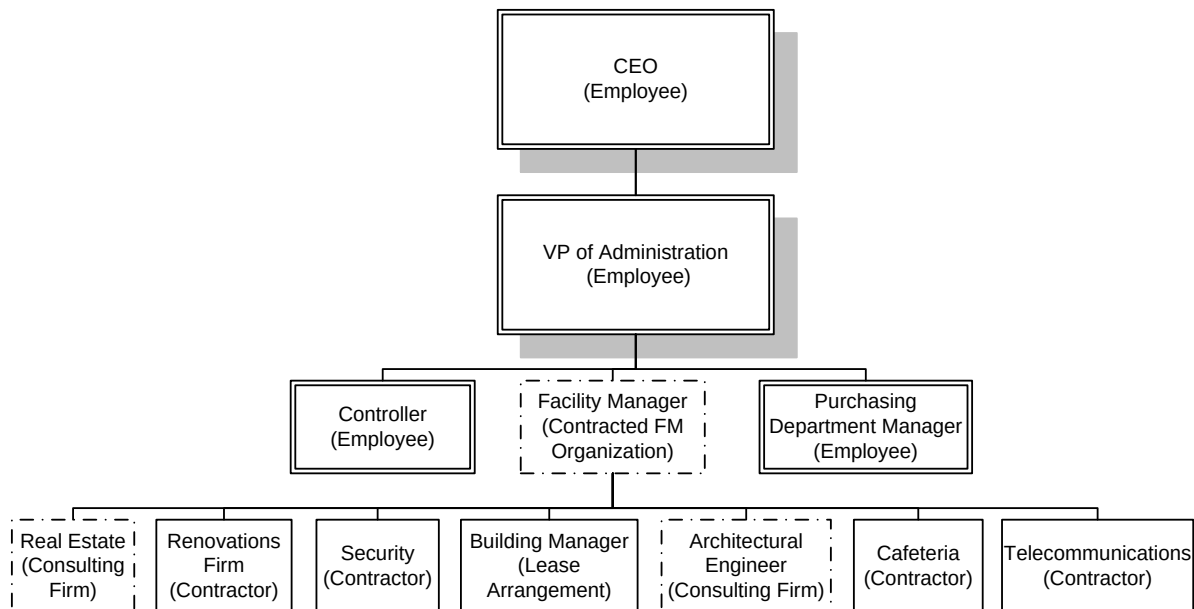
Note also that deciding who should fill the role of project manager and the roles of project team members may not be known until the project is defined and agreed to in the form of a project charter (discussed later). Therefore, the facility manager may temporarily fill the role of project manager for FM projects until more information is available to make this decision.

When deciding whether to fill the role of project manager and/or use internal FM staff for the project team, delegate the task to an in-house project manager, hire a project manager and/or project team members, or contract out the management of the project and/or the project as a whole, the facility manager considers the following for the proposed project.

- **Client representative (external) or coordinator (internal) role.** Some FM organizations fill a client representative role, meaning that they are externally contracted resources that serve their clients. When this is the case, the FM organization may be very lean and rely heavily on contractors.

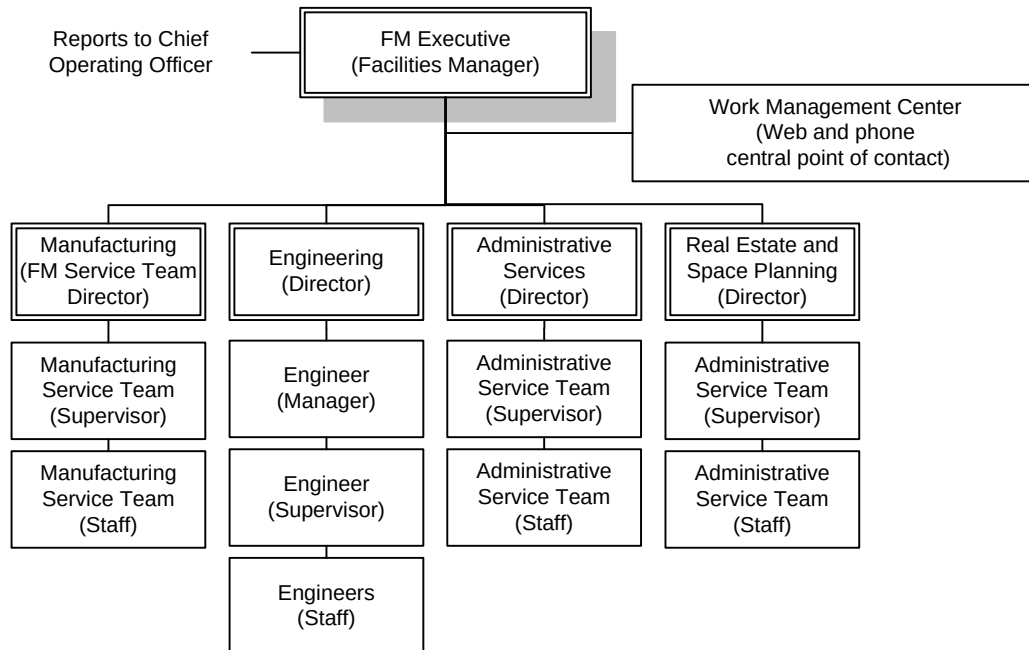
An example of such an organizational structure is shown in Exhibit 4-32.

Exhibit 4-32: Organizational Structure for a Client Representative (External) Role



In other cases, the FM organization is an internal department or business unit in a larger organization, and the facility manager occupies a coordinator role. An example of this type of organizational structure is shown in Exhibit 4-33.

Exhibit 4-33: Organizational Structure for a Coordinator (Internal) Role



This factor may impact the options available to the facility manager and what the client/senior management tends to expect in terms of the use of external/internal project management and project teams.

- Complexity and frequency.** Complexity refers to the project itself, while frequency refers to how often the facility manager or FM organization has managed or will manage such a project. The facility manager makes an assessment of the technical complexity of the project and whether such projects are rarely or frequently handled by the facility manager and the FM organization. The facility manager accounts for the risk of project failure due to insufficient experience of leaders or team members. In other words, the facility manager determines whether the personal skills and experience of the proposed project manager and project team members match the project's requirements.

Complex capital projects usually need team members with specialized skills and education. Therefore, such projects may require the use of professional



services including architects, engineers, and building contractors as well as hiring additional staff to exercise proper control, for example, construction accountants, construction procurement specialists, inspectors or expert estimators.

- **Availability and capacity.** Even when a project is within the capabilities of the facility manager and the FM organization, the facility manager considers the impact of the project's demands on the workload of the total FM organization. Brief projects and projects that require only a part-time commitment could be handled by the facility manager and FM organization. Extended projects and projects that require a full-time leader and/or a large proportion of available FM staff time are generally delegated to in-house or contracted resources. If the facility manager decides to run such a project, he or she will need to make arrangements for the management of regular FM activities while the project is ongoing.

Another consideration is whether or not there are any available fallback resources with applicable skills and experience in the event that problems occur with the project or an emergency requires diverting the attentions of the selected project manager or project team members.

- **Benefits and risks.** The benefits and risks of facility managers assuming the role of project manager and FM staff becoming team members must be weighed against the benefits and risks of delegating these roles to internal or external resources. Some of the risks already mentioned involve relative experience levels, availability, and capacity. The risks to other FM organizational duties when diverting resources to this project are also assessed.

Benefits that facility managers and FM teams may experience when getting involved in a project include that it may provide opportunities for personal growth and increase job satisfaction by providing more responsibility. Benefits of delegating the work could include reduced risk of project failure and freedom to pursue other strategic or tactical endeavors.

Topic 3: Project Management Processes and Models

Project planning can be a formal or informal process depending on the scope and complexity of project tasks. Formal project planning employs standardized project



management processes and models that are similar across organizations. Informal project planning is a process of asking questions about the project such as:

- What must be done?
- Who will do it?
- How should it be accomplished?
- How long should it take to complete?
- How well should it be done?
- How much will it cost?

While asking such questions will help plan a simple project, more complex projects can benefit from a standardized project management process to ensure that no important categories of project planning are omitted. Most standardized processes also include the concept of project cycles, which help conceptualize that projects are developed iteratively (starting with a framework and returning to add details as they become known or changes as they are approved).

Standardized project management processes

Standardized project management processes can be beneficial because they present consistent terminology and provide a framework that can be adapted to project specifics. Standardized processes can ensure that no important project components are omitted.

Motivating an organization to adopt a standard set of processes and commit to an increased amount of planning work may be a process in itself. While the project manager is expected to provide expertise and structure to a project, organizational resistance to change cannot be underestimated.

If the project manager wants to follow a specific methodology for projects, he or she may need to have buy-in from superiors and also sell the idea to the project team.

PMBOK knowledge areas

One of the oldest and more widely accepted standardized project management processes is the Project Management Body of Knowledge (PMBOK) of the Project Management Institute (PMI). It includes a set of project management knowledge areas that aid in understanding the breadth of tasks involved in managing a project.

The knowledge areas can be described as follows:

- **Integration management** is the coordination of tasks and persons, including control of project changes.
- **Scope management** is the cataloging of tasks to determine and control the extent of work to be done.



- **Time management** is making a schedule to complete the project on time, detailing when to start and finish each task.
- **Cost management** estimates costs, which, if accurate, help to develop a realistic budget that can be used to control costs.
- **Quality management** applies quality tools to measure and correct tasks and deliverables to suit the project's purpose.
- **Human resource management** staffs, develops and manages the project team (employees and/or contractors).
- **Communications management** maintains timely and appropriate communications with all stakeholders.
- **Risk management** produces and executes a plan for managing risks ranked by their likelihood, severity and manageability.
- **Procurement management** specifies contracts for and manages use of materials and professional services.

Management of projects of any size will address each of these areas, for example:

- Producing formal plans for each area in an overall project management plan for complex projects.
- Addressing each as less formal considerations for smaller projects.

Project cycles

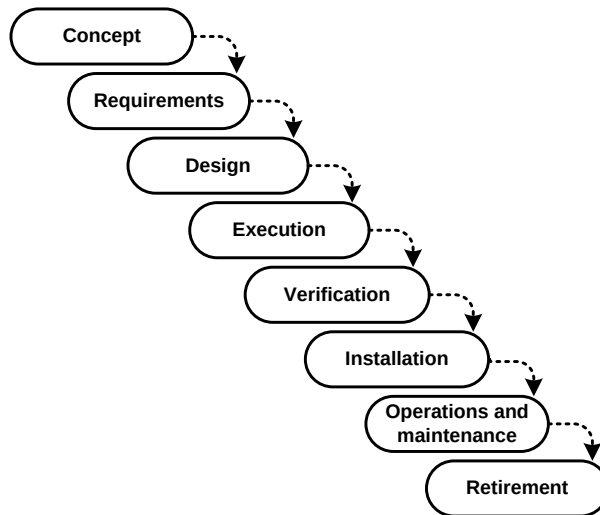
Project models show how to organize the steps/phases involved in producing and executing a project management plan or individual plan phase.

The phases differ depending on the type of project and the areas that need to be controlled. Phases can also be defined as the points where work or deliverables are passed to a different group or individual. Models can be useful because they help organize work, deliverables and teams by what is needed for each phase. The following are two models.

- **Traditional waterfall model.** Exhibit 4-34 shows how a traditional model illustrates a set of phases relevant to the type of project and how work flows from one phase to the next in sequence, without any concurrent phases or allowance for the possibility that a task would need to be revisited.

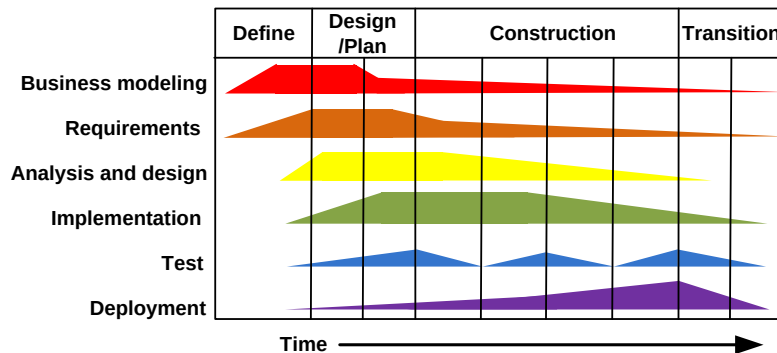


Exhibit 4-34: Waterfall Model



- Iterative models.** Exhibit 4-35 illustrates one version of an iterative model. Iterative models address deficiencies in the traditional waterfall model by incorporating concepts of concurrent work and planned iteration, or a scheduled return to prior phases as new information is discovered. Most project models are iterative.

Exhibit 4-35: Iterative Model (One of Many Variants)



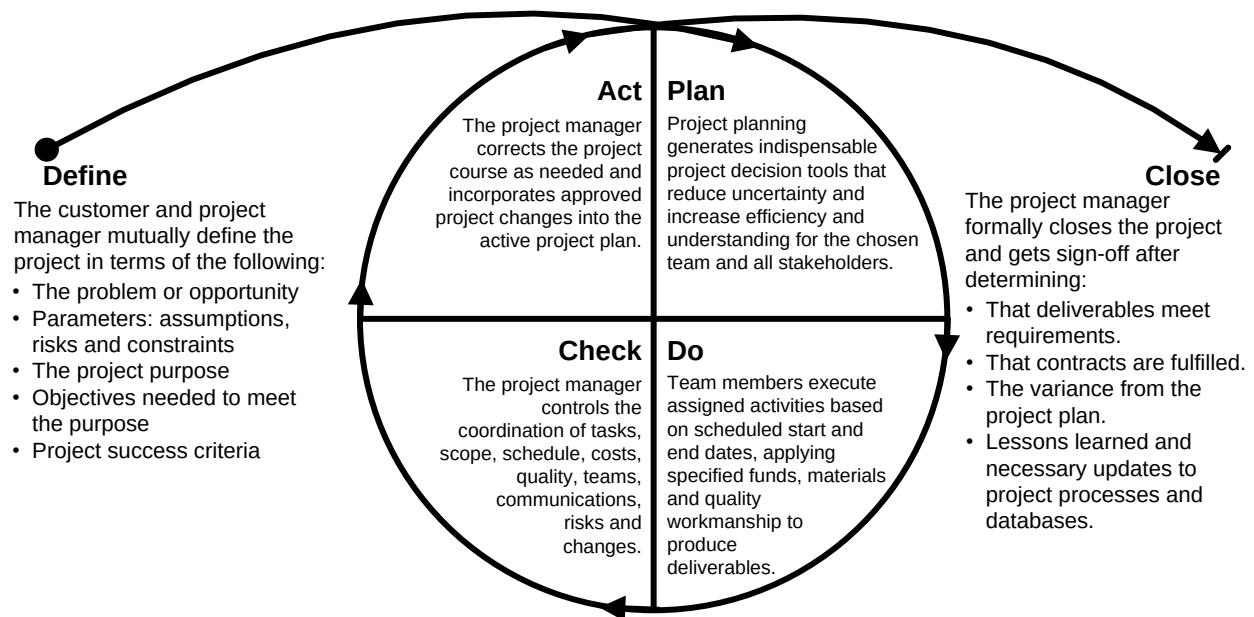
Iterative models start by defining a framework for a plan and, as the project progresses, the framework is incrementally augmented in greater and greater detail. Planned iteration is also called progressive elaboration because each pass further elaborates on the information gathered in the last effort. The cycle is repeated until the plans are sufficiently detailed to enable execution. The process of moving from the general to specific for each element of a project is captured in the Plan, Do, Check, Act model.



Plan, Do, Check, Act model

The Plan, Do, Check, Act model is an iterative model that has four phases: Plan, Do, Check and Act. The results of each phase serve as the inputs to the next phase, and the cycle can be repeated numerous times to capture the results of changes and progressive elaboration. Plan, Do, Check, Act was defined by Shewhart and modified by Deming for use in quality management. Since projects always have a beginning and an end, Define and Close phases are added to the basic model in Exhibit 4-36.

Exhibit 4-36: The Plan, Do, Check, Act Model with Define and Close Phases for Projects



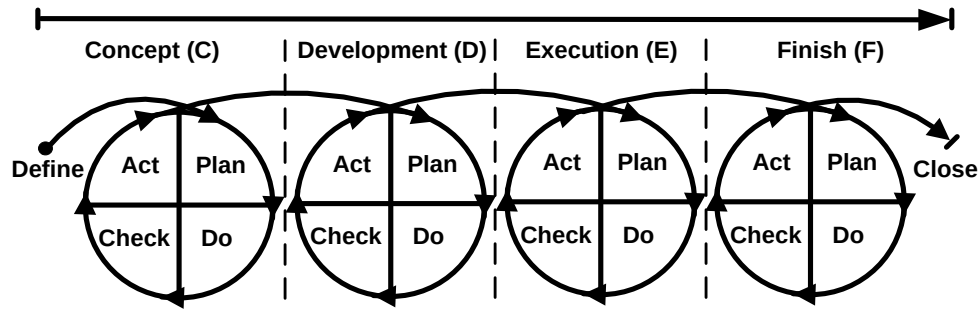
This discussion refers to Define, Plan, Do, Check, Act and Close as project phases. However, each organization may use its own terminology to describe these phases, and they might be grouped differently. For example, the C, D, E, F model uses Concept (C) for Define, Development (D) for Plan, Execution (E) for Do/Check/Act, and Finish (F) for Close.

Apply models to entire projects or project phases

The Define, Plan, Do, Check, Act, Close model is not just a simple summary of a project. The model can be applied to the project process as a whole as well as to individual phases or elements within a project. Exhibit 4-37 illustrates this concept using the C, D, E, F model for the overall project phases and the Define, Plan, Do, Check, Act, Close phases to show how each phase has its own internal cycle. Note that the Close phase of each interim cycle becomes the Define phase for the next.



Exhibit 4-37: Project Schedules Incorporate Iteration Using Project Cycle Models



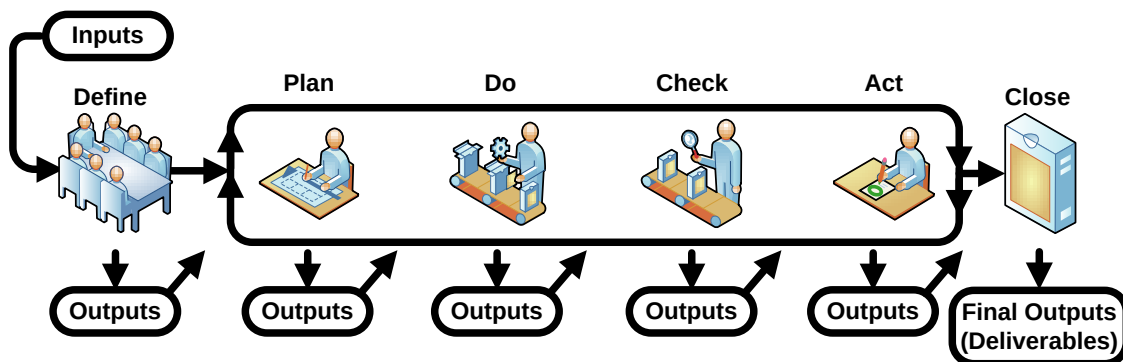
For example, when developing a project objectives statement, the process of generating an idea for a project and defining its purpose are the Define and Plan phases. Do, Check and Act are performed as the objectives statement is developed, validated and revised. The finished document (output) is approved in the Close phase, and this becomes the Define phase or input for the next project phase.

Some work for a project may be also designed as a project in its own right with its own cycle. Feasibility studies are often performed as a separate project because it is unclear at the start of the feasibility study whether a project will be recommended and what the nature of the project will be. Feasibility studies are sometimes conducted as part of project selection, which is discussed in Topic 1 of Chapter 2.

Project management overview

Exhibit 4-38 is an overview of the project model used for this competency. It shows the basic inputs to most projects, a development process and documentation or deliverable outputs in the Define, Plan, Do, Check, Act, Close project phases.

Exhibit 4-38: Project Model Inputs, Processes and Outputs



A version of this graphic is repeated in the remaining chapters and topics to show specific inputs, processes and outputs related to that topic.

Project format

Exhibit 4-39 shows a predefined project management process format with some additional high-level tasks included in list form for a sample relocation project. This is called a work breakdown structure (WBS). The WBS is discussed later in this competency, but it is basically a list of project tasks. The WBS in the exhibit is set to a calendar for the project duration, which has a hard relocation deadline of 9/1, so this milestone and the milestone indicating project kickoff are included.

Exhibit 4-39: Typical FM Project Format

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Define need Approve project charter Develop project objectives Identify stakeholders Assemble initial project team Hire consultants Identify assets to be moved Plan solution Develop project mgt. plan Assemble project team	 9/1												
Acquire space Conduct site search Select site/sign lease													
Design space Request bids Select bidder/sign contracts Generate preliminary design Review and approve design Generate final design and construction drawings													
Construct space Apply for permits Request bids Select bidder/sign contracts Conduct project kickoff Execute construction Conduct inspections Review as-built drawings Review punch list/correction													
Occupy space Hire contractors (movers) Plan furniture construction Orient employees Construct furniture Install network/telecommunications Relocate IT Relocate office/special items													
Close project Perform corrective moves Adjust furniture/equipment Evaluate outcome													

Milestone

9/1



Progress Check Questions

Directions: Read each question and respond in the space provided. Answers and page references follow the questions.

1. In the Define, Plan, Do, Check, Act, and Close model, the outputs of the Close phase become
 - ☐ a. the inputs to the Plan phase.
 - ☐ b. the inputs to the Do phase.
 - ☐ c. the final project deliverables.
 - ☐ d. the inputs to the Check phase.
2. Which of the following is true of projects or project management?
 - ☐ a. Projects can have an indefinite end date.
 - ☐ b. Projects can be summarized as the application of project scheduling tools.
 - ☐ c. Project management for facilities is the same as facility management.
 - ☐ d. Project management is distinct from but a subset of regular facility management activities.
3. Which of the following could be described as a problem scheduled for solution?
 - ☐ a. Project management
 - ☐ b. Programming
 - ☐ c. Project
 - ☐ d. Process model
4. Which of the following is true of projects?
 - ☐ a. Projects can have an ongoing, indefinite charter.
 - ☐ b. Projects are one-time, unique sets of events.
 - ☐ c. Projects employ permanent teams.
 - ☐ d. Projects are clearly distinct from and do not overlap with other facility work.
5. A minor project for a specific department is frequently funded
 - ☐ a. using capital funds.
 - ☐ b. using the FM organization's capital funds and no reimbursement is made.
 - ☐ c. using the FM organization's operational funds and no reimbursement is made.
 - ☐ d. using the affected department's operational funds.
6. When facility managers are acting as a project manager, they narrow their focus to which of the following key tasks? (*Select two answers*).
 - ☐ a. Using scheduling to provide complete assurance that a plan is realistic
 - ☐ b. Focusing on labor productivity and job costs
 - ☐ c. Tracking permissions, materials and equipment
 - ☐ d. Maintaining the direction of the project even if stakeholders are not satisfied



7. Which the following is a valid argument for having the facility manager and FM staff be the project manager and project team for a facility management project?
- ☐ a. This project is highly specialized and complex and thus will have a higher probability of project failure if contractors perform it.
 - ☐ b. This type of project, while new to the FM organization, is growing ever more frequent and the facility manager and FM staff need opportunities for personal growth.
 - ☐ c. Full-time devotion to this project will free up FM organization resources to pursue strategic goals.
 - ☐ d. This project will increase the workload of the facility manager and FM staff, who will also need to continue regular duties, and the added responsibility should increase job satisfaction.
8. Returning to a prior project activity each time more data is available is called
- ☐ a. planned iteration.
 - ☐ b. concurrent work.
 - ☐ c. scope management.
 - ☐ d. integration management.



Progress check answers

1. c (p. 4-152)
2. d (p. 4-140)
3. c (p. 4-137)
4. b (p. 4-137)
5. d (p. 4-139)
6. b, c (p. 4-141)
7. b (p. 4-147)
8. a (p. 4-150)



Chapter 2: Define Projects

After completing this chapter, students will be able to:

- Indicate the importance of beginning with the end in mind or defining a project's purpose and criteria for success from the start.
 - Link projects to strategy and apply other project inputs, including financial plans, project selection, specifications or scope/statements of work (SOWs), constraints, and policies, procedures, and practices.
 - Recognize how to conduct programming for a project to determine user requirements and produce a statement of requirements.
 - Describe how a project charter is used to present a conceptual budget and business plan to decision makers to win project approval and funding.
 - Discuss how a statement of objectives is used to detail project scope and deliverables and constraints of schedule, budget and quality in sufficient detail to begin project planning.
-

✦ Topic 1: Define Phase and Project Inputs

Define phase

The Define phase of the project model is the phase in which a project's purpose is defined and the project is approved and funded. The purpose is sometimes an identified problem to be solved or a strategic objective or opportunity to achieve. Often these problems or opportunities are gathered from user requirements through a process called programming.

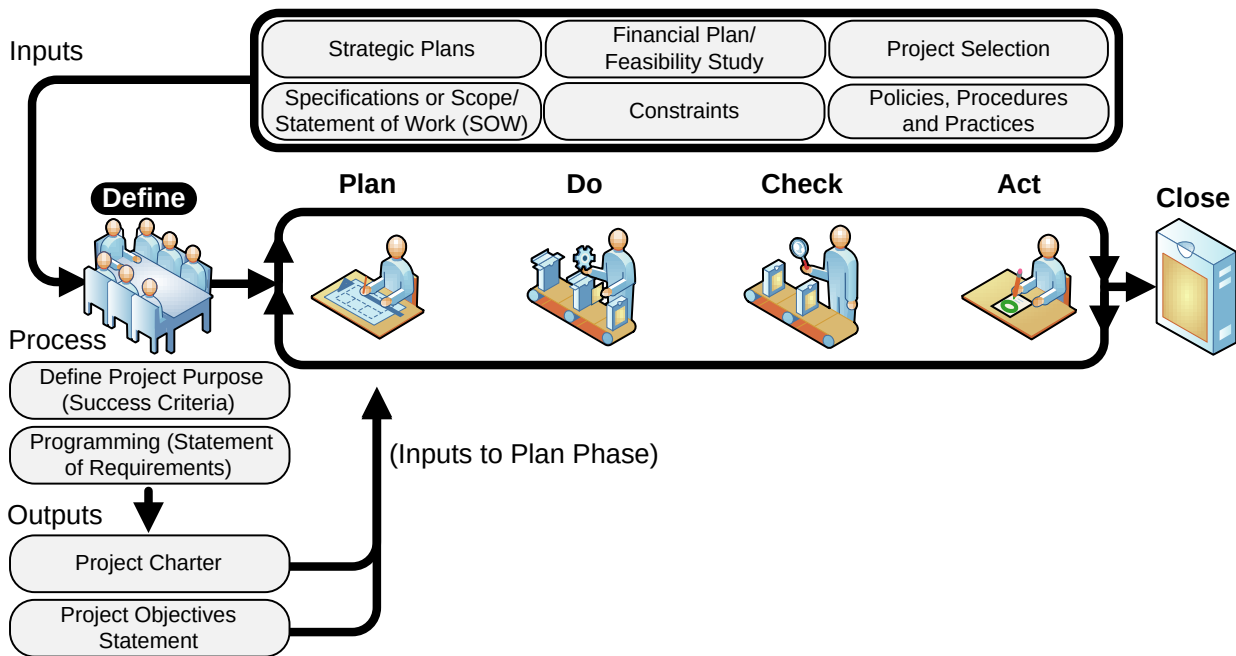
In the Define phase, projects begin with the end in mind and then plans are produced and executed to get to that end. This end or purpose is explicit, agreed to by all stakeholders, and clearly indicates what the project will contribute to the entire organization.

While projects can range greatly in scope from simple landscaping or repairs to major acquisitions with design and construction, all projects require a well-defined purpose and adequate funding and resources to achieve the purpose.

Exhibit 4-40 shows the inputs, processes and outputs of a project during the Define phase. (Note that the model addresses Topics 1 through 4 of this chapter.)



Exhibit 4-40: Inputs, Processes and Outputs in the Define Phase



In the Define phase of a project, the project manager performs or delegates the following tasks:

- Gather or produce the appropriate inputs (addressed in this topic).
- Perform the process of defining the project purpose, which includes generating a set of success criteria (Topic 2 of this chapter).
- Perform the process of programming, which includes generating a statement of requirements (Topic 3 of this chapter).
- Develop the outputs of a project charter and a project objectives statement (Topic 4 of this chapter).

Inputs

Inputs to the project in the Define phase are resources and constraints that provide the motivation for projects to be proposed, affect whether or not a project will be approved and funded, provide useful tools and resources, and set the scope of a project within feasible limits. Exhibit 4-41 on the next page shows details of what is discussed in this topic.

Note that many of these inputs could be produced as independent projects, taken from previously completed projects, or performed as preliminary project phases for the current project.

Exhibit 4-41: Define Phase Inputs

Strategic Plans • Strategic facility plan • Facility master plan (real estate master plan)	Financial Plan/ Feasibility Study • Estimated costs • Estimated benefits • Financial analysis	Project Selection • List and rank projects • Select project • Validate selection
Specifications or Scope/ Statements of Work (SOWs) • Business case • Initial scope and requirements	Constraints • Facilities register • Human resources base • Time constraints • Disruptions to customers or work processes • Organizational structure/culture • Standards and regulations • Macroeconomic and societal conditions • Organizational tolerance for risk • Available software • Site-specific constraints	Policies, Procedures and Practices • Common policies, procedures and practices, including: • Estimation policy • Relevant permits, codes and standards • Project resources

Note also that most of these inputs can be used for any project in one form or another. For example, a very simple equipment replacement project may be linked to FM strategy for preventive maintenance; assessed for feasibility (e.g., repair or replace analysis); have some constraints (e.g., replace during non-core business hours); and follow relevant policies and procedures (e.g., policy for approval and tracking of expenses).

Strategic plans

Strategic plans, if available and applicable to the given project, may include the strategic facility plan and/or the facility master plan (or real estate master plan).

- **Strategic facility plan.** Many projects are generated to enact elements of a strategic facility plan, which aligns the FM organization's long-term strategy to the strategic plans (or business plans), mission, vision, goals and objectives of the entire organization. Moving strategy from theory into action is a challenge that can be facilitated through the use of projects and project management.

If a project addresses elements of a strategic facility plan, the relationship is made explicit in the project charter and project objectives statement. Satisfaction of strategic goals can be a major selling point when seeking project approval.

For example, if part of the strategic facility plan is to reduce the lease costs of the entire organization, a project to relocate all occupants of a leased facility into an owned building would be explicitly linked to that



strategic goal and the success criteria would include the overall percent reduction in use of leased space.

- **Facility master plan (real estate master plan).** Facility master plans, also called real estate master plans or campus plans, are detailed strategic-level analyses of particular sites and specifications for their development.

These plans present scenarios that are alternative options for enacting the goals of the strategic facility plan. If facility master plans are being used, the Define phase could be devoted to selecting an appropriate scenario and implementing it as a project. The detailed information in a facility master plan can be used as inputs to the project objectives statement and the project management plan, the main planning document for the project.

Financial plan/ feasibility study

A financial plan or feasibility study is a critical element of any project because project funding is a critical go/no-go decision point for a project of any size. Projects are considered tentative until they have received funding approval. Without approval and allocation of capital or expense funds through a project charter, there is no project.

A financial plan or feasibility study specific to a project should address estimated costs, estimated benefits and financial analysis.

- **Estimated costs.** Estimated and potential project costs are expressed in ranges to provide room for planning but also include a total probable cost estimate. Costs are broken down by line items to provide an appropriate level of detail.
 - **Cost of engineering requirements.** Engineering requirements are an assessment of the expertise and specialized equipment or infrastructure needed to complete a project.
 - **Hard costs.** Hard costs are actual expenses that can be readily determined or estimated in advance.
 - **Soft costs.** Soft costs are costs that are difficult to determine or estimate because they relate to lost productivity, opportunity costs for use of organizational assets and internal staff, impact on customers, learning curves or employee morale. Other soft costs may include expenses that are highly variable, such as architectural and engineering fees or commissioning.
 - **Other costs.** The plan addresses all other costs such as administrative and financing costs.



- **Estimated benefits.** Measurable financial benefits and benefits that require subjective assessment are provided in a range from conservative to optimistic for the project. The total probable benefit is also estimated.
- **Financial analysis.** The financial analysis uses a variety of tools to indicate the value proposition of the project. Key measurements include the following:
 - **Return on investment (ROI)** in terms of project management is a measure of how well the funds invested in a project increase (or are projected to increase) the financial resources of the organization. It is equal to the annual project return divided by the average annual project investment.
 - **Payback period** refers to the length of time it will take to recoup the initial investment cost—in other words, how long it will take to earn back the funds spent on a project.
 - **Internal rate of return (IRR)** is the return on investment a company typically realizes (or targets) based on its past track record regarding asset investments.
 - **Life-cycle cost** is the total cost of acquisition, operation, maintenance and support of an item throughout its useful life, including the cost of disposal. Life-cycle cost can provide a rationale for including maintainability and sustainability in plans.

Note that other financial measures such as present value or net present value are also used. These and other financial terms are introduced in the *Finance and Business* competency.

Project selection

How does a project get recommended for development? Many FM projects begin as the output of project selection. Project selection is a method of listing and ranking potential projects so that a project can be selected and the choice validated as the best possible expenditure of resources over a given time period. Project selection could be run as a separate project or as a preliminary project phase. It may be part of a feasibility study or incorporate the results of such a study in project rankings.

When competing or alternative options exist for achieving a strategic goal or solving a problem, project selection helps facility managers make a decision on the type of project that is desired and feasible. For example, if the FM



organization needs to renovate a building, project options could be to only replace carpet and repaint walls or to gut and replace the facility interior.

Project selection has the following steps:

- **List and rank projects.** Potential projects are defined and their pros, cons, risks, feasibility, costs and benefits are used to rank them.
- **Select project.** The highest-ranked project is selected.
- **Validate selection.** The choice is analyzed to determine if it is the project offering the best result at the lowest risk. An alternate project is selected if the first choice proves to be infeasible or too risky or if the project fails to win approval in the form of a project charter during the Define phase.

Specifications or scope/statements of work (SOWs)

A specification is a description of the essential technical requirements for items (hardware and software), materials and processes that includes verification criteria for determining whether the requirements are met. A scope of work or statement of work (SOW) is the part of a contract that lists the specific tasks to be performed.

If the FM organization serves internal customers, executives may supply specifications to initiate a project; if the FM organization serves external clients through contracts, the client may supply a scope/statement of work to initiate a project. Internal executives or clients who initiate projects are collectively referred to in this document as project sponsors.

Elements of a specification/SOW may include a business case and initial scope and requirements.

- **Business case.** A business case provides the sponsor's rationale for pursuing the project, such as satisfaction of the sponsor's strategic goals, expectation of profit or fulfillment of legal requirements. The business case specifies the intended use of the deliverables and the project's purpose and success criteria (discussed later in this chapter).
- **Initial scope and requirements.** The specification/SOW describes the project's envisioned scope in terms of the tasks involved, critical deadlines, expected cost and quality, and the final deliverables in a narrative format to enable stakeholders to develop a common understanding of the purpose of the project.

The specification/SOW may include a statement of requirements (see Topic 3 of this chapter). The scope and requirements should be detailed enough to develop a project objectives statement (see Topic 4 of this chapter).



Constraints

Constraints are the organization's assets, attitudes and organizational structure that limit the extent of projects. Outside factors can also create constraints that influence a project. The following are possible constraints.

- **Facilities register (inventory of equipment or portfolio of properties).** The inventory and relative condition of buildings and equipment may influence the project scope.
- **Human resources base.** In-house project team candidates or departments (e.g., purchasing) are sorted by their skill set, experience and availability.
- **Time constraints.** Hard project deadlines or milestones are those that must be met for the project to be considered successful.
- **Disruptions to customers or work processes.** Minimizing disruption may require limiting project tasks or hours/days of allowed project work.
- **Organizational structure.** Plans may account for reporting structures such as a project manager being a line (vertical) or staff (horizontal) authority.
- **Organizational culture.** Organizational culture or corporate philosophy influences how projects are identified and prioritized, how communications occur, and necessary sensitivity to internal politics.
- **Standards and regulations.** Organizations may voluntarily apply quality or sustainability standards or be subject to government agency regulations such as environmental impact restrictions.
- **Macroeconomic and societal conditions.** The national or global environment may influence projects, for example, prices or available credit.
- **Organizational tolerance for risk.** Risk tolerance influences which projects get approved; higher risk usually requires higher potential return.
- **Available software.** FM organizations may (or may not) have access to project software for scheduling, project management, design, building information modeling (BIM), information collection and distribution, etc.
- **Site-specific constraints.** Site-specific constraints may include the impact of weather or the initial terrain conditions of a site.

Policies, procedures and practices

Some policies, procedures and practices are non-negotiable; however, the project format may allow project managers to alter or omit others if they would hinder rapid project development.



The organization may have project-specific policies, procedures and practices that are required or available for projects. A best practice is to continually improve these tools based on lessons learned from prior projects.

Policy, procedure and practice inputs to a project may include:

- Standard project phases and processes.
- Environmental, health and safety policies or regulations.
- Quality policies and tools such as facilities audits.
- Sustainability policies.
- Project tools such as templates for task and schedule documents.
- Financial audit and control procedures.
- Guidelines for project communications.
- Problem reporting and change control procedures.
- Risk estimation tools and guidelines.
- Final product or service evaluation, validation, and acceptance process.

Three items need to be discussed in more detail: estimation policy; relevant permits, codes and standards; and project resources.

Estimation policy

Estimates are used in every aspect of defining and planning a project, and the accuracy of the estimates is directly related to the accuracy of the plans that are produced. Estimation policy sets rules for how to make estimates and how to record the precision of these estimates.

A consistent methodology for estimation is documented and the process is followed throughout the project. Policy may dictate that the individual closest to a process perform estimates for that process, or the policy may require two or three individuals to produce individual estimates and then come to an agreement on a consensus estimate. When multiple estimators explain the rationale behind their estimates, the consensus estimate captures more relevant factors and is more likely to be accurate.

Estimation is a skill that requires training and experience to develop as well as specialized knowledge of the area being estimated. A best practice is to have the person who will perform the project work participate in making the estimate. To assist team specialists, organizations may hire or contract with formally trained estimators, for example, a cost estimator.



Because estimates can vary widely, estimation policy requires estimators to document information on how the estimate was made, for example:

- Unit of measure and amount of rounding (e.g., to the nearest day or US\$100).
- Source of historical reference data (e.g., from Project XYZ two years ago).
- Assumptions that were made (e.g., wiring is labeled prior to move).
- Risks that could alter the estimated amount (e.g., rising fuel prices).
- A tolerance range (e.g., ± 5 percent for a time estimate or ± 20 percent for a contingency on a conceptual budget).
- Uncertainty level (e.g., this is a ballpark estimate and needs to be refined).
- How long the estimate will be valid (expiration date).
- Actual time taken/cost for the task (recorded later to report on accuracy).

The necessary facts for estimates are not always known at the time of the initial estimate. Therefore, the estimation policy includes methods for refining estimates as new information is discovered.

Relevant permits, codes and standards

The project manager's role in regard to permits is to ensure that the appropriate person completes the requirements and has these in place at the right time so that they do not create a bottleneck or result in corrective work. Project managers also verify that the project follows applicable codes and standards.

If a general contractor is involved in a capital construction project, the general contractor obtains the building permit, but the facility manager and design firm are involved to help prevent/resolve any building code or zoning issues. Building departments or building authorities may require design changes before issuing a building permit. If a general contractor is not yet selected for a project, the facility manager could provide local officials with a preliminary set of documents for review or the project architect or a permit expeditor can apply for the permit. In this way, the process can be done concurrently with the general contractor bidding and award process. Providing this material or initiating the application during the early planning stages can optimize the permitting process. If inspectors find that intermediate and final work complies with all relevant requirements and codes, they issue a certificate of occupancy, which allows occupancy or use.

Model building codes adopted by states or local jurisdictions, such as the International Building Code, Plumbing Code, and Mechanical Code, usually



refer to other codes and standards that must be followed. Codes and standards that may be referenced include:

- National Electric Code (NEC or NFPA 70).
- NFPA codes and standards (e.g., NFPA 10, 13, 25, 72 and 101).
- ASHRAE 62 (Ventilation for Acceptable Indoor Air Quality).
- ASME A17.1 (Safety Code for Elevators and Escalators).
- Disability access codes (e.g., Americans with Disabilities Act, Barrier Free Act).
- International Mechanical Code.
- International Plumbing Code.
- International Building Code.
- Fire codes.
- HVAC codes.
- Gas codes.
- Life safety codes.
- LEED accreditation.
- International/national sustainability codes.
- Lighting energy efficiency codes (region/state/city).
- Other legal and mandatory requirements.

Project resources

The organization may or may not have project resources in the form of software, Web resources, or archived electronic records, spreadsheets, and templates to leverage when developing project plans, for example:

- Project management software and scheduling software.
- Online project management collaboration tools (for remote project team member management and collaboration).
- Baseline data on project scope, labor and materials costs, quality, space planning, scheduling and performance measurement.
- Benchmarking data, cost estimating data, risk data, process measurement data.
- Contingency plans.
- Lessons learned from prior projects.
- Archives of all prior projects, including documentation on prior versions or configurations of hardware and software.

Note that the facility manager/project manager can also gain an understanding of applicable local and national building codes by consulting with the project's architect or engineer.



✦ Topic 2: Define Project Purpose

The purpose statement for a project is an indication of the project's reason for being done, and it specifies the project's size, scope, schedule, budget and quality at a high level.

The following are excerpts from the global job task analysis that indicate some of the information included in a project purpose statement:

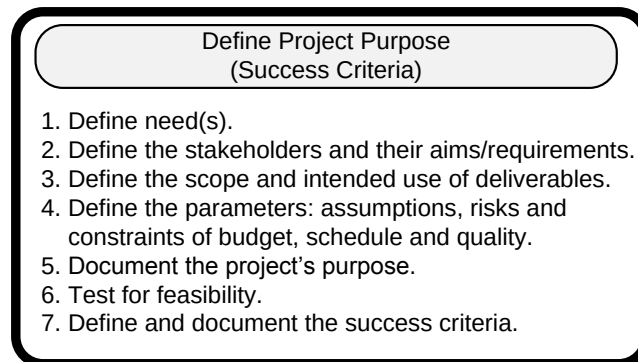
- Time and resource constraints are defined.
- Applicable standards, regulations and laws are identified.
- The size and specifics of the project are documented.

The process of defining the project purpose can be described as a cycle of validation that requires the project manager to negotiate with the project sponsor (senior executive or client) to determine priorities and separate what is necessary from what is desired, to achieve consensus with stakeholders regarding a feasible purpose for the project, and to document this purpose using a set of success criteria.

Defining what constitutes a successful project goal up front or starting with the end in mind helps project managers and team members generate a plan to reach that goal. Routine success on projects can be achieved if the project manager leads the project sponsors to clearly define the purpose of the project and what would constitute a successful project resolution. The project manager can then develop a realistic plan.

Exhibit 4-42 shows details of what is discussed in this topic.

Exhibit 4-42: Define Phase Process of Defining Project Purpose



Define need(s)

A project can be defined as an organizational need (problem or opportunity) scheduled to be addressed, for example, cost reductions or specific strategic goals. As noted above, the sources for these identified needs are usually inputs such as strategic plans, specifications/SOWs, financial plans/feasibility studies or the results of a project selection process.

Project managers work closely with project sponsors to develop a shared understanding of the nature of the need(s) to be addressed. Documenting the business need is the first step in ensuring that the project has a clear purpose that everyone agrees to and will work toward. The ongoing case study in this course, which addresses many considerations of a relocation project, documents the following issues needing resolution:

The current leased headquarters facility is projected to be inadequate for desired growth needs, is an energy-inefficient building, and has a lease that expires September 1, 20xx, at which time the premises must be vacated. Any proposed solution must address these issues.

Define stakeholders and aims/requirements

A project's stakeholders are persons or organizations that have an interest in the project's funding, resources, processes or results. Key stakeholders include the project sponsor, the project manager, team members, users of the deliverables and the larger community affected by the deliverables. At this point, only high-level aims/requirements are recorded. If programming is already complete, the statement of requirements is used as a resource; if not, the requirements are estimated and later refined.

Define scope and intended use of deliverables

Next, the project sponsors and the project manager come to an agreement on the scope of the project and the intended use of the project deliverables. Scope is the extent of work or tasks to be done to produce a project's deliverables (products or services) and can be defined as the end results or deliverables themselves. Scope implies minimum and maximum limits on deliverables to ensure that the deliverables satisfy their purpose but omit unnecessary features.

The intended use for deliverables should be as single-minded as possible. A single use represents a clear mission, while multiuse increases the potential for conflicting needs. A deliverable intended for more than one use tends to be more complex and expensive to develop than two separate deliverables, each with a single intended use.

Define parameters

The parameters of the project encompass the assumptions of project sponsors and other stakeholders, risks that could endanger project success, and key constraints. The primary constraints for a project include budget, schedule and quality. Budget, or cost, is a limitation that affects the resources that can be



purchased, leased, contracted or internally allocated. Schedule, or time, is a constraint on the overall project duration or the timing of certain events, including compensation for resource availability or minimizing disruptions. Quality is a broad constraint that encompasses quality work, quality materials, the number of deliverable features, and the level of effort to be expended.

These three constraints form the basis for three common project parameters:

- The project needs to be done quickly (fast).
- The project needs to be accomplished with a minimum of funds (cheap).
- The project must result in the highest-quality deliverables (meets expectations and specifications).

Clearly stating if any parameters are nonessential is just as important as stating the project's priorities because the project manager can adjust accordingly. For example, a project may specify that a lower grade of materials is acceptable.

Document project's purpose

The purpose for the project is a summary of the project's need(s), stakeholder requirements, scope and intended use of deliverables, and project parameters. A project purpose indicates what to achieve, not how to achieve it. The purpose states the essential and nonessential parameters.

Test for feasibility

Once documented, the purpose is tested for feasibility, because an unrealistic purpose or a purpose that leaves some elements to be determined later makes project failure more likely. Defining true priorities from the start avoids the syndrome of wanting it all and having to settle for less. What must be sacrificed later may not be what decision makers would have chosen in advance.

Given a feasible purpose, a realistic approach can be defined that will make project success highly probable.

The project triangle can be used to measure the feasibility of a purpose. It shows how the constraints on a project's purpose are interdependent and affect feasibility.

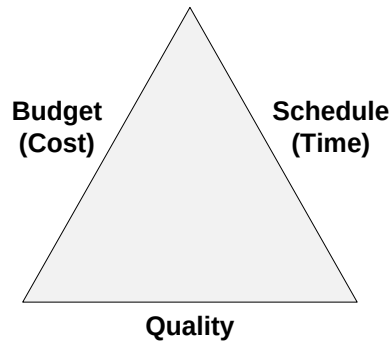
The three sides of the triangle can be used to illustrate the project constraints of budget (cost), schedule (time) and quality. Other versions of the project triangle list constraints such as schedule, resources, and scope or time, cost, and resource availability. In each version, the intent is to show that changes to one constraint affect the other constraints. There is a delicate balance for the optimums in price, time and quality in a project. For example, if a project



schedule must be expedited, costs are likely to increase and the quality of work may also suffer.

The project triangle is illustrated in Exhibit 4-43.

Exhibit 4-43: The Project Triangle



The project manager uses leadership and influence to guide project sponsors to create a purpose that optimizes all project constraints to the maximum amount that is feasible. Project managers achieve feasible optimization by helping sponsors to dictate only the most important objectives and leave the others to the project manager's discretion or provide a range that is acceptable.

For example, if cost is discretionary, the project manager develops a plan that includes a realistic budget that can achieve the nondiscretionary items. If the discretionary items of the proposed plan (such as cost) are not acceptable, then the project sponsor needs to revisit the purpose or cancel the project.

Define and document success criteria

Success criteria are the combinations of conditions that must be met or satisfied for the project, plan or task to be considered a success. They are specific, measurable and agreed upon by stakeholders.

Success criteria are directly linked to all of the factors that make up the purpose of a project. They are vital to developing a shared understanding between the project sponsor and the project manager. Formal sign-off on the criteria can set reasonable expectations and prevent later misunderstandings.

Note that success criteria avoid specifying the means by which the criteria are to be achieved, because success could occur through various means (although if project plans are executed correctly, there is a higher likelihood of success).



✦ Topic 3: Perform Programming

After defining the project's purpose, including its general, high-level requirements, a more detailed statement of project requirements must be created. This is referred to as programming. Programming and the statement of user requirements can be defined as follows:

- **Programming** is the process that defines the detailed project requirements of the end user that are needed to meet the project objectives and general project requirements. Programming is a type of analysis that employs user observation, interviews and surveys to identify and detail a specific function in an organization, sometimes improving functionality (e.g., when translated into a new design for a space). Programming is documented as a statement of requirements.
- A **statement of requirements, project requirements program, or program** is a document that provides the interface between the customer (end user) and the people who are responsible for transforming space into a productive work environment (design professionals). Programs include space utilization and criteria for support systems.

Programming enables the project to be designed and/or planned in the Plan phase. It is usually conducted by design professionals, who could be internal staff members such as space planners or contracted resources such as interior designers or architects.

What programming is or is not can be clarified by relating it to other project concepts:

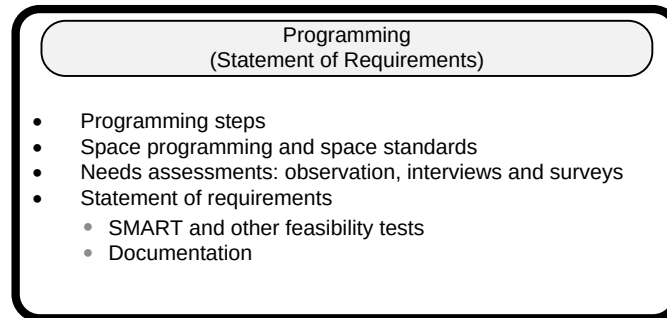
- Programming is similar to needs analysis because both determine user requirements, but programming is related to user needs and physical requirements while needs analysis is broader, analyzing business processes or feasibility.
- Programming differs from feasibility studies because statements of requirements initially list all user requirements without constraints and feasibility studies or budgeting is needed to confirm that the requirements are feasible for the project.
- Programming makes projections of future user needs similar to forecasting but, unlike forecasting, focuses on only a specific set of problems.



- Programming is distinct from design or project planning; rather, it is a prerequisite for these tasks.
- Programming is more detailed than macro-level programming, which is strategic-level programming.

Exhibit 4-44 shows details of what is discussed in this topic.

Exhibit 4-44: Programming



Programming steps

While organizations may differ in their specific programming process and steps, typically these are the basic steps in programming:

1. Define the programming scope, goals or success criteria. (The project's purpose and success criteria can be used.)
2. Get approval for the programming from sponsors (executives/clients) and from affected line managers to give the programming tasks specificity.
3. Set a schedule with deadlines for programming tasks.
4. Refer to or establish programming standards for the specific function (e.g., space standards for space programming).
5. Gather data on personnel by role and business unit/department.
6. Assess user needs through observation, interviews or surveys.
7. Combine the user data and user requirements with the standards to produce requirements by user role, by business unit/department and in total.
8. Produce and present a statement of requirements (e.g., a space planning statement of requirements or program for space design).

Space programming and space standards

To illustrate how programming uses organizational programming standards, let's look at some organizational space standards.

Space programming determines user needs for the amount and configuration/features of physical space based on user role or business unit/department needs.



Space standards are developed to generalize how much space is needed for a given task, user role or group function, such as standard sizes for executive offices, cubicle space (often two or three variants), conference space, etc. These standards are typically defined by specific dimensions per person or per specific role. The dimensions are then translated to square meters (or square feet) per person or role. The space standards are then applied to the total number of persons in each internal demographic (role) to develop requirements for all occupants. The auxiliary (support) space requirements and circulation space requirements are added to determine the overall facility space requirements.

Facility space has its own terms and standards when measuring area to allocate for shared spaces, corridors and individual spaces. The following area-related terms are used when categorizing space and developing space standards (terms sometimes differ for owned versus leased space):

- **Gross area** is the sum of the floor areas on all levels of a building that are totally enclosed within the building envelope (measured to the outside face of exterior walls).
- **Rentable area** is the gross area minus exterior walls, major vertical penetrations and interior parking spaces. In leased space, this area includes shared spaces with other tenants.

Rentable area = Gross area – (Exterior walls + Major vertical penetrations + Interior parking space)

- **Useable area** is the portion of a building or floor available for occupants. In leased space, this is the area not shared with other tenants.

Useable area = Rentable area – (Building core and service area + Primary circulation)

- **Core and service area** is the area with common access (or benefit) to all users within a gross space (e.g., public corridors, restrooms, mechanical or utility rooms, and vestibules). Also called common area, common support area or core area.
- **Primary circulation** is the portion of the building that is a public corridor or a lobby or is required for access by all occupants on a floor to stairs, elevators, restrooms and/or building entrances.



- **Secondary circulation** is the portion of a building required for access to some subdivision of space (whether bounded by walls or not) that is not defined as primary circulation, e.g., corridors between workstations.
- **Assignable area** is the portion of a floor or building used to house personnel, furniture and equipment.

Assignable area = Useable area – Secondary circulation

- **Core and service area factor (rentable/useable ratio)** is the factor used to determine a tenant's pro rata share of the core and service area. Also called common area factor, core factor or loss factor.
- **Circulation factor** is a percentage added to work space to allow for circulation patterns of persons or goods in usable space.

In addition, some facility strategies and programming standards are intended to accommodate more staff without increasing space, such as use of visitor space or hoteling. These spaces are often set up to be used on a first-come, first-served basis, but sometimes spaces can be reserved in advance.

Needs assessments

Needs assessments are used to solicit inputs from multiple stakeholders to discover and document previously unstated needs. It is through a needs assessment that an organization finds out what users/customers really want. Experienced design professionals can distinguish needs from wants and incorporate that distinction into the statement of requirements.

Needs assessments take the form of observation, interviews or surveys:

- **Observation.** Design professionals observe tasks and record the actual processes used. They ask questions to clarify their understanding.
- **Formal interviews.** Interviewers ask a set of predefined open- and closed-ended questions to ensure that nothing is left assumed. Interviews are relevant for user requirements but tend toward big-picture information.
- **Informal interviews (conversations).** Interviewers use conversations to get a general picture and allow stakeholders to raise issues important to them.
- **Customer surveys or questionnaires.** Surveys and questionnaires are useful for large user populations and can use open- or closed-ended questions. They are useful when an issue is well-defined and consensus needs to be established, but data compilation can be time-consuming.



If the user population is large, observation and interviews can be limited to a statistically relevant selection of the population. Statistical relevance refers to the number of persons contacted relative to the total number but also requires that input be received from persons at all levels, including:

- Executives.
- Board of directors.
- Line managers/department or business unit heads (e.g., finance).
- Staff by role.
- Contractors by role.
- Occupants/tenants.

While talking to stakeholders at all levels helps with eventual deliverable acceptance, the most emphasis for a needs assessment is on input from line managers and staff. For example, in space programming, line managers can be a valuable resource for indicating required interdepartmental and internal adjacencies or workflow. Staff members know details of the business processes and can provide information on exceptions to standards/rules.

While documentation on user needs and problems is unconstrained by cost feasibility at this point, trained observers still differentiate between what is necessary versus what is desired. Necessary requirements should relate to the project purpose and be driven by business needs such as managing costs or increasing productivity or morale. Programming should maintain focus on those things required to perform (or possibly improve) the end user's function.

Also, programming objectives may require application of value engineering. Value engineering is a systematic approach to assessing and analyzing the user's requirements of a new asset and ensuring that those requirements are met but not exceeded. It consists primarily of eliminating perceived "non-value-adding" features of a project or new equipment. It can also be thought of as eliminating items whose value/benefit are not compensating for their associated cost (as shown in a cost-benefit analysis). Value engineering is needed because end users typically try to justify more requirements than are truly necessary.

Statement of requirements

A statement of requirements demonstrates an understanding of the current state of the system being modeled but is primarily focused on forecasting. That is, it expresses how to optimize and fulfill projected or forecasted system needs.

A statement of requirements generated solely for a project is used to define the project's requirements. It is also used as a benchmark throughout project



planning to validate project objectives and the project management plan. Therefore, if the statement of requirements is changed, the plans and contracts based on it will also need to be modified.

A statement of requirements could include:

- Usage or occupant needs and requirements.
- Forecasts for departmental growth and space needs.
- Time frames or milestones associated with significant project results.
- Critical adjacencies between and within departments.
- Desired support areas and amenities.
- Departmental security and safety needs.
- Energy and utility specifications.
- Infrastructure requirements.
- Desired image of the organization.
- Proposed space standards.

Statements of requirements may address any number of facility areas, such as compliance with codes, regulations, laws, policies and standards; sustainability and environmental impact; interior environment; or social and psychological impact of potential changes.

Requirement categories include the following:

- **Strategic facility plan/facility master plan requirements** can be traced from strategic plans to project requirements as applicable.
- **Engineering requirements** are detailed technical requirements of deliverables and the materials and expertise needed to produce them, including special civil or mechanical, electrical and plumbing (MEP) requirements for facilities. Engineering requirements may specify required levels of maintainability and sustainability.
- **Customer requirements** are elicited from those who will manage, use and support the deliverables.
- **Design requirements** are usually produced by a design firm for capital construction projects.
- **Space requirements** show details of space planning and relocation needs, including space for each occupant and department.
- **Building commissioning requirements** document the life cycle and operational requirements for a building. (Commissioning is a systematic process to ensure that building performance is in harmony with the intent and specifications of its design and the operational needs of its owner.)



SMART and other feasibility tests

Just as the project purpose is tested for feasibility, requirements are also tested individually and as a whole for feasibility. The SMART concept applies multiple measures to assess feasibility. SMART is an acronym that indicates the elements of this feasibility test, defined as follows for testing individual requirements:

- **Specific.** Each requirement is clear and concise and states how to enact a single element of the project purpose.
- **Measurable.** Each requirement is defined in terms of how to measure whether it is satisfied (measure of success or degree of success [quality]).
- **Achievable (attainable).** Each requirement does not conflict with other requirements and can be met using existing skills and assets or through training, purchasing or contracting.
- **Realistic (relevant).** Each requirement is feasibly optimized. See the project triangle discussion in Topic 2 of this chapter for information on making trade-offs.
- **Timely.** Requirements include accurately estimated deadlines to promote efficiency and provide a baseline for reporting and control.

Other feasibility testing can determine if the set of requirements as a whole is necessary and sufficient:

- **Necessary.** If any criterion or requirement were omitted, the purpose would not be fully expressed.
- **Sufficient.** No additional criteria or requirements need be (or should be) added.

It is also advisable that the statement of requirements be “agreed upon.” Getting stakeholders to commit to a set of requirements at the start encourages a detailed review and promotes buy-in at later stages by setting expectations and minimizing politics and midproject change.

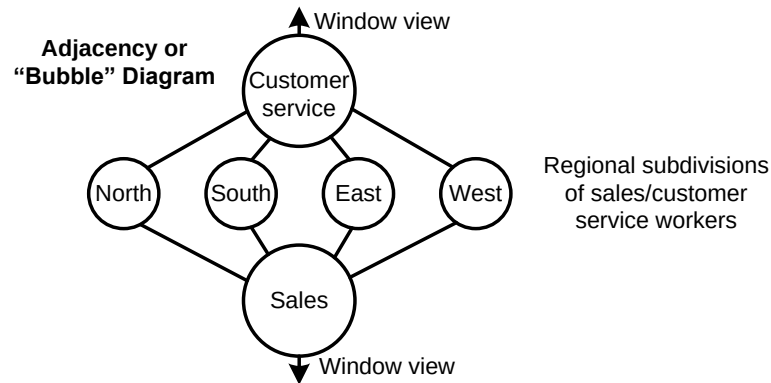
Documentation

Statement of requirements documentation may include the following components:

- **Project goals and requirements.** Goals and requirements are expressed at an executive overview level.
- **Adjacency or “bubble” diagrams.** Adjacency diagrams model department and work group primary and secondary adjacencies. Exhibit 4-45 shows an example.



Exhibit 4-45: Adjacency Diagram



- **Space standards.** Space standards list office and workstation standards.
- **Shared support area requirements.** This section documents shared space needs such as new support area size and interior layout plans.
- **Departmental matrixes and departmental support areas.** This section combines current and future staffing count with job title or space standards to calculate total and usable space requirements for a department in square meters (square feet).
- **Square meter (square feet) summary sheet.** This section summarizes the space needs of all departments and support areas based on space standards.
- **Opposing or conflicting needs.** This section lists incompatible requirements from different user groups and may propose solutions.
- **Impact on customers/tenants.** Customers/tenants indicate times and/or areas requiring special coordination for project work.
- **Approvals.** Stakeholders review, comment on and sign off on the statement.

✦ Topic 4: Create Project Charter and Project Objectives Statement

The outputs of the Define phase include a project charter, which summarizes the project purpose and seeks approval and funding, and a project objectives statement, which provides sufficient detail on scope and constraints to enable creation of the project management plan, the primary planning document for



the project. Note that organizations use various names to refer to these documents and that the documents can be combined into a single deliverable.

Exhibit 4-46 shows details of what is discussed in this topic.

Exhibit 4-46: Define Phase Outputs

Project Charter	Project Objectives Statement
• Business case or funding request • Approvals • Initial project team selection	• Scope and deliverables documentation • Schedule (time) documentation • Budget (cost) documentation • Quality documentation

Project charter

A project charter is a document used to justify and allow formal authorization of a project and release funds, prove that the project has a viable business case, list project requirements, link the project to strategy, and name persons responsible for the project, including the project manager. It can also be called a project request form, project documentation or capital project justification.

It is good practice to have a project charter on every project and possibly for each project phase if the project has a long duration. However, every organization will have different requirements to satisfy in order to get approval and project funding. The basic sections of a project charter typically include the business case or funding request, approvals, and the initial project team selection.

Business case or funding request

A business case or funding request summarizes the project's scope, purpose and success criteria from an organizational perspective and directly links the project to organizational and FM strategy, if applicable. For example, it may outline the business need for the project such as legal requirements, customer requirements, market demand or social needs. It may also refer to stakeholder needs in the form of a statement of requirements.

This portion of the document is primarily a financial cost summary and justification for those costs. Therefore, a conceptual or preliminary budget is set out for project sponsor approval. Conceptual budgets are established prior to the preparation of a design solution. Broad industry standard unit pricing or historical costs can be used as the basis for developing a conceptual project budget. Due to the schematic nature of conceptual budgets, a contingency, expressed as a percentage of total anticipated costs, is included to cover unanticipated scope items that are added as the project is developed.



Conceptual budgets can be developed using similar past projects. For example, for real estate projects, the conceptual budget would be expressed in a monetary amount per square meter (square foot) plus an inflation factor or a geographic cost difference factor.

Approvals

Approvals name those accountable for the project and indicate whether these parties have formally signed off on the project.

Approval elements include (but are not limited to):

- **Project sponsor/owner.** The project sponsor or owner is identified, including the sponsor's place in the approval process.
- **Project manager and project manager's authority level.** The project manager is documented along with the project manager's level of authority and direct superior.
- **Formal project authorization and funding approval.** The project manager gets formal authorization for the project to proceed from all required sources. No approval equates to no project.

Initial project team selection

The initial project team may consist of just the project manager or may include one or more persons responsible for development of the project objectives statement and project management plan. The project charter may list one or more initial project team members and provide their basic qualifications, especially if the charter is being reviewed by a client.

Ideally, initial project team members are available for the entire project to provide continuity, with the exception of specialists such as contracted resources intended solely for a specific function such as producing a design.

Project objectives statement

The project objectives statement is a document used to state what the project will (and will not) accomplish in terms of its scope and deliverables. It includes a high-level schedule, a budget, and quality standards. It is also called an initial project scope document, a project description document, or a project definition document.

The primary purpose of the project objectives statement is to provide a framework for development of the project management plan during the Plan phase. The project objectives statement is a further development of the Define phase processes of defining and programming and may either directly reference a statement of requirements or select a subset of the requirements as dictated by what was approved in the project charter.



A project objectives statement may include whether certain project-specific elements are included, for example:

- Starting building commissioning during project design.
- Starting sustainability efforts during project design.
- Programming for maintainability.

The statement of objectives can be a brief document for simple projects or a detailed document for complex projects. Project managers and teams may have access to technology such as scheduling tools or a project management information system (PMIS) that can help develop the statement of objectives and position it as a framework for further development into a project management plan.

A project objectives statement usually includes the following elements:

- Scope and deliverables documentation
- Schedule (time) documentation
- Budget (cost) documentation
- Quality documentation

Scope and deliverables documentation

The document includes a preliminary scope estimate that includes acceptance criteria, broad scope controls and limits to project tasks. The final deliverables (products or services) are listed. The elements of scope documentation are high-level or general in nature, but the tasks are described in enough detail to allow development of a work breakdown structure (WBS) or task list during the Plan phase. Elements of the scope/deliverables portion of a project objectives statement include:

- **Executive overview of product or service deliverables.** The executive overview is a high-level overview of the purpose of the project and describes its deliverables. It defines the project in terms of what it should achieve and its limits. It also provides a rationale for the project such as a strategic, business or social need.
- **Statement of requirements.** A statement of requirements may be included in the scope documentation as is or adapted to the particular project.
- **Limits to the project scope.** The limits to the project scope are elaborated to guide later planning and reduce chances of miscommunication.
- **Project deliverables or services.** The project deliverables (products or services) are listed and characterized.
- **Initial work breakdown structure or task list.** The major tasks involved in the project are listed.



Schedule (time) documentation

During the Define phase, the time estimate is at a high level but sets a schedule that the project manager believes is realistic. Schedule documentation is sufficiently detailed to develop a project schedule in the Plan phase. Elements of schedule documentation include:

- Hard delivery dates and their source.
- Schedule milestones.
- Time constraints.
- Approvals needed per milestone.

Budget (cost) documentation

Cost documentation provides a broad overview of how much the project will cost and may provide a range of estimates from conservative to optimistic. It is detailed enough to produce detailed cost estimates and budgets during the Plan phase. Cost documentation includes:

- Initial cost estimates, broken down into major categories or line items.
- Initial staffing costs.
- Conceptual project budget, reflecting resource requirements in terms of staff, equipment and materials, usually differentiating between hard and soft costs.
- Contingencies.

Quality documentation

Quality documentation describes the expected level of effort, inherent characteristics of deliverables, and assumptions, risks and constraints in sufficient detail to produce numerous parts of the project management plan:

- **Grade of deliverables.** The grade (technical features) of deliverables is listed, broken down by the same line items as the initial cost estimate.
- **Initial risks.** Obstacles or risks to project success are identified.
- **Assumptions.** Any project assumptions, such as the use of specific facility equipment or in-house personnel or departments, are set forth.
- **Customer impact.** The impact of the project on customers' work schedules, people and systems is described, including communications, work interruptions or needed training. Methods to accommodate opposing or conflicting needs may also be discussed.
- **Constraints.** The impact of constraints such as those discussed previously as Define phase inputs are also included in the quality documentation.



Progress Check Questions

Directions: Read each question and respond in the space provided. Answers and page references follow the questions.

1. A relocation project involves moving several departments to different areas within the same facility. Which of the following team members would have specific details on user requirements?
 - ☐ a. Lease owner
 - ☐ b. Facility manager
 - ☐ c. Design professional
 - ☐ d. Legal department

2. A corporation produces a long-range plan outlining its broad, high-level goals for serving its customers. Which of the following is referenced when demonstrating how a facility management project is directly linked to this plan?
 - ☐ a. Project charter
 - ☐ b. Strategic facility plan
 - ☐ c. Project objectives statement
 - ☐ d. Success criteria

3. Which of the following could a project manager do to expedite the permitting process on a capital construction project if the general contractor is not yet selected?
 - ☐ a. Issue a certificate of occupancy.
 - ☐ b. Perform the work in the expectation that a permit will eventually be issued.
 - ☐ c. The project manager cannot expedite the process because a general contractor is required.
 - ☐ d. Provide local officials with a preliminary set of construction documents.

4. Which of the following is done after defining a project's purpose and could be accomplished using a tool such as the project triangle?
 - ☐ a. Test the purpose for feasibility.
 - ☐ b. Define the priorities for the project.
 - ☐ c. Define the intended use of the project deliverables.
 - ☐ d. Develop a statement of objectives.

5. A project sponsor indicates that a project should build a facility at the lowest cost, in the least time, and with the highest quality. Which of the following should the project manager do?
 - ☐ a. Implement the project with the given parameters.
 - ☐ b. Work with the sponsor to define more feasible parameters.
 - ☐ c. Tell the sponsor he will need to settle for lower quality.
 - ☐ d. Agree to a definition of quality as assuming use of the lowest grade materials.



6. Which of the following is true of success criteria?
- ☐ a. Success criteria can be partially met and the project can still be considered a success.
 - ☐ b. Success criteria defined by the project manager require no agreement by stakeholders.
 - ☐ c. Success criteria specify the means by which success must be achieved (following plans).
 - ☐ d. Success criteria must be measurable.
7. Which of the following is true of programming?
- ☐ a. Programming is a prerequisite for construction project architectural designs.
 - ☐ b. Programming avoids making projections of future needs and so differs from forecasting.
 - ☐ c. Programming is less detailed than macro-level programming.
 - ☐ d. Programming differs from needs analysis because the latter does not determine user requirements.
8. Which of the following types of stakeholders generally need to provide approval for programming to begin (so that interviews, observations and surveys can be conducted)? (*Select two answers.*)
- ☐ a. Senior executives or clients
 - ☐ b. Expert design professionals
 - ☐ c. Affected line managers
 - ☐ d. Affected end users
9. Which of the following area terms is defined as the facility rentable area minus the building core and service area and primary circulation?
- ☐ a. Useable area
 - ☐ b. Gross area
 - ☐ c. Hotelling area
 - ☐ d. Common support area
10. When developing a conceptual budget for a project charter, which of the following can be used as the basis for the budget amounts?
- ☐ a. Industry standard unit pricing
 - ☐ b. Winning contractor's bid
 - ☐ c. Actual costs
 - ☐ d. Data from design construction documents for completed projects



Progress check answers

1. c (p. 4-171)
2. b (p. 4-159)
3. d (p. 4-165)
4. a (p. 4-169)
5. b (p. 4-170)
6. d (p. 4-170)
7. a (p. 4-172)
8. a and c (p. 4-172)
9. a (p. 4-173)
10. a (p. 4-179)



Chapter 3: Plan Projects

After completing this chapter, students will be able to:

- Determine the basic steps in design/engineering of deliverables or space, including acquisition of space.
 - Understand how to create a project management plan and describe methods and tools for forming a work breakdown structure/task list, a project schedule, cost estimates and budgets, a quality management plan, a communications management plan, and a risk management plan.
 - Plan a project team and resources by forming project team and internal staff and contractor specifications.
 - Relate how to form a procurement management plan.
 - Understand contract details.
-

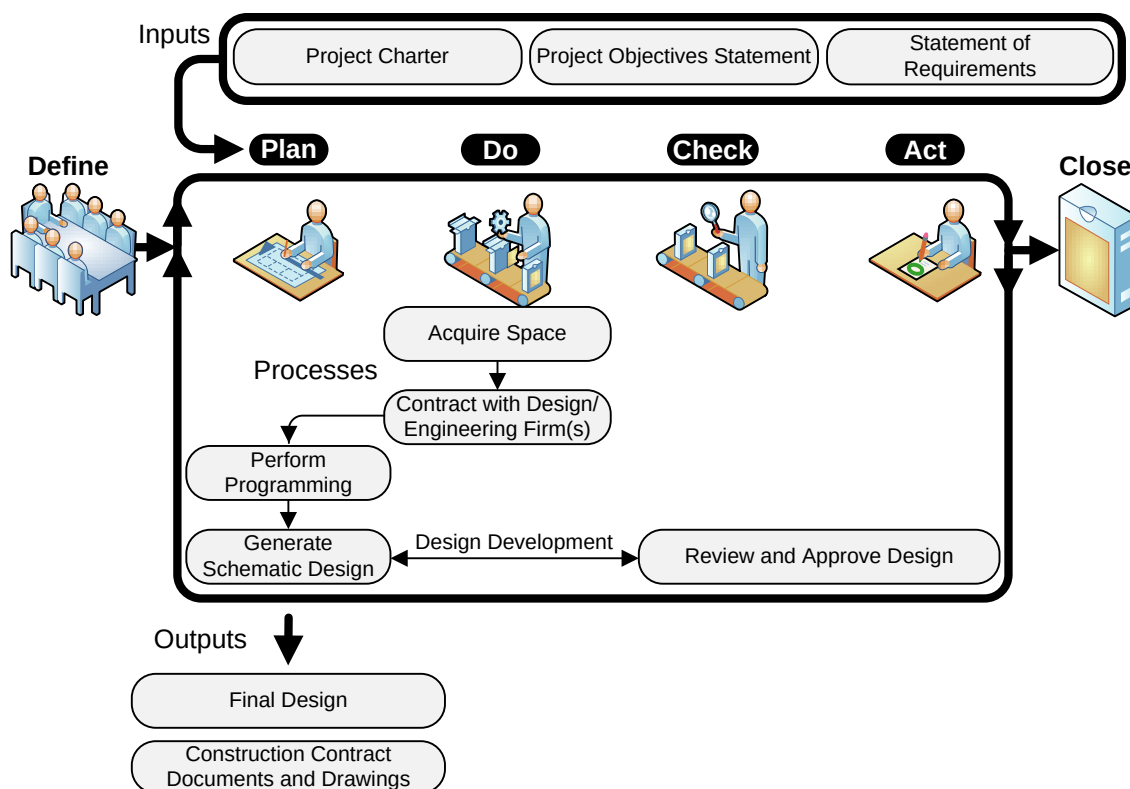
✦ Topic 1: Design Deliverables or Space

Designing/engineering deliverables or space is necessary when projects require development of complex engineered deliverables or capital construction. Many FM projects require no design work and can omit this step, proceeding directly to development of the project management plan (Topic 2 of this chapter).

When design is required, development of the project management plan may be done prior to the design as a framework and revisited after the design is finalized. It could also be performed concurrently or initiated after the design is complete. Organizational practices or schedule optimization may dictate this decision.

The tasks discussed in this topic fit into the Plan, Do, Check and Act project phases. Exhibit 4-47 provides an overview of the inputs, processes and outputs for design tasks, showing how design work and engineering work are primarily Plan phase processes and outputs but some activities can be seen as belonging in the Do, Check and Act phases.



Exhibit 4-47: Inputs, Processes and Outputs for Designing Deliverables or Space

This topic is organized as follows:

- Acquire space.
 - Create site selection criteria.
 - Conduct site search.
 - Conduct building evaluation.
 - Purchase or lease space.
- Contract with design/engineering firm(s).
- Conduct the design process.
 - Perform programming.
 - Generate schematic design.
 - Design development (including review and approve design).
 - Generate final design and construction contract documents/drawings.

Acquire space

Acquiring space for an organization is a long-term strategic decision. The facility manager/project manager may be involved in recommending a site based on project requirements, but the decision rests with senior executives/clients.



The steps in acquiring space typically include creating site selection criteria, conducting a site search, and conducting a building evaluation. Once a selection is made, the organization purchases or leases the space.

Create site selection criteria

Site selection criteria are created to determine the optimum type of site for a facility. These criteria address factors such as:

- Occupant requirements, including total square meters (or feet) and special spaces, e.g., 1,000 square meters (~10,800 square feet) unobstructed space.
- Desired location.
- Desired cost per square meter (square foot), including rent and operating expenses, construction costs and the allowance for tenant improvement.
- Desired floor plan/stacking plan (e.g., a small floor size/high-rise facility or a large floor size/low-rise facility).
- Desired amenities.

The total cost is weighed against the desired space configuration to determine a solution that fits requirements and makes financial sense. For example, for new construction, site selection criteria may determine that although high-rise construction is more costly, its smaller floor size (or floor plate) could reduce total costs if land costs are at a premium. For acquisition of existing facilities, site selection criteria can help optimize the property search based on land/building costs versus location and site amenities.

Conduct site search

The project manager contracts with a corporate real estate broker, who conducts a site search based on a summary of the requirements listed in the statement of requirements, statement of objectives and site selection criteria. The broker presents a selection of sites that meet minimum requirements and works with decision makers to narrow the list of sites.

Conduct building evaluation

A building evaluation may be conducted when an existing facility might be acquired. The purpose of a building evaluation is to determine if an existing building will meet the infrastructure needs of planned occupants at an acceptable price after purchase/lease, design/construction, and maintenance costs are factored in. The decision factors involve making trade-offs between location, cost and satisfaction of occupant requirements.

Common steps in a building evaluation are to:

- Compare/contrast floor size (floor plate) configurations for each site.
- Evaluate power and other physical infrastructure.
- Evaluate general building condition (e.g., roof, mechanical systems).
- Evaluate accessibility for persons with disabilities.



- Evaluate fire and life safety equipment (e.g., sprinkler systems).
- Acquire data on prior building inspections and accessibility compliance.
- Generate a test fit. A test fit is a scale drawing showing a proposed layout of space for business units or departments to determine if the space can adequately address space requirements.

The project manager presents the results of the building evaluation(s) to decision makers, who select a site.

Purchase or lease space

The organization negotiates with the property owner through a broker and legal counsel when making an offer on a property. For purchases or leases, there may be a property or lease review by legal, risk management and environmental auditors. Organizations negotiate the purchase/lease price. In the case of leases, lease duration, tenant improvement allowance and other contract terms are also negotiated. A tenant improvement allowance is money set aside by a landlord in accordance with a building standard for use by a tenant to make the space suitable for occupancy. The size of the allowance can vary by the duration or structure of the lease or other factors negotiated in the contract.

Given successful negotiation and legal review, the representatives of the organization and the owner sign the necessary contracts.

Contract with design/engineering firm(s)

If an architectural design and/or civil engineering firm (also called an MEP, or mechanical, electrical, plumbing, engineering firm) is needed to develop designs and construction documents and drawings, firm(s) can be selected using a tender/bidding and selection process as described in Topic 1 of Chapter 4. Sometimes the architectural/engineering firm is selected due to a previous working relationship or other qualifications instead of a tender/bidding process.

When selecting a design/engineering firm, the project manager ensures that the selected firm is a good match for the specialized project content, the organizational culture, the project team and the project manager.

The design/engineering firm's tasks are directed by a scope/statement of work, which would include a task schedule and deadlines for deliverables.

When working with design/engineering firms, project managers encourage an atmosphere of collaboration to ensure the best design possible. However, even though this function is usually outsourced, the project manager is accountable for results and therefore retains control over the design process.



Design process The design process normally follows several phases of progressive detail:

- Perform programming.
- Generate schematic design.
- Design development.
- Generate final design and construction contract documents/drawings.

Perform programming

The design firm will provide design professionals to develop the space planning program. The space planning program is a statement of requirements that lists the requirements the design must meet in detail. The design professional uses a range of programming techniques such as soliciting input from end users when developing the program (see Topic 3 of Chapter 2).

A high-quality design requires high-quality inputs. If the statement of requirements is unambiguous and sufficiently detailed, then designers/engineers will have the necessary tools to realize the deliverables. Ensuring that designers or engineers are addressing the right problems/opportunities and controlling scope creep are the key tasks for the project manager throughout the design process.

Generate schematic design

Schematic designs, also called preliminary designs or conceptual designs, are high-level conceptual design tools used to translate the statement of requirements into rough-draft visual plans. Schematic designs include rough sketches, bubble diagrams, adjacency diagrams, stack plans, and schematic design drawings. The intent of the schematic design phase is to arrive at a comprehensive solution concept, a design solution that is agreed to by all involved parties.

Design development

During design development, the solution concept is translated into more formal drawings and documents following a staged review and approval process. Design professionals design and detail each aspect of the solution until a final design is achieved and approved. They may employ a number of presentation tools to convey the intent of a design to decision makers, including architectural/engineering scaled drawings, renderings, scale models, three-dimensional models, or virtual tours.

Review and approve design

Design development drawings and documents are periodically presented to decision makers for review, modification and approval. Stakeholders typically review the design at predetermined progress stages such as at 30, 60, and 90 percent complete. Each organization will specify its own review format.



Generate final design and construction documents/drawings

Following each comment period, the design is updated. A final design is generated once the designs are complete and approved.

The final design is translated into construction contract documents and construction drawings to provide qualified contractors with sufficient detail to build the deliverable or facility correctly using specified materials and practices. The construction contract documents contain the necessary specificity for a construction project to be priced, permitted, planned and properly executed. Construction contract documents and construction drawings can be defined as follows:

- **Construction contract documents** are a portfolio of detailed documents that generally consist of a construction agreement, general terms and conditions, supplementary conditions, construction documents (including construction drawings and specifications), addenda, a notice to proceed, payment and performance bonds, and change orders.
- **Construction drawings** are scaled architectural or engineering drawings that include notations on the work required and the materials to be used, showing how to proceed with construction. Construction drawings are usually provided as part of a larger set of construction contract documents.

In addition to producing approved documents and drawings for construction contractors, designers/engineers may produce drawings intended for other stakeholders who require less detail. For example, schematic plans or drawings are scale drawings that include all basic design components of a space or facility, such as circulation corridors, partitions and work space areas, but omit construction details and dimensions.

✦ Topic 2: Create Project Management Plan

The project management plan is the primary planning document for the project. It identifies the scope of deliverables and the tasks that need to be done; includes a schedule, cost estimates and a budget; and indicates how to manage quality, communications, risks, project team specifications, procurement and project changes.

This plan is developed from the project charter, the project objectives statement and the final design and construction documents (if used). Many project management plans are created using project management and/or scheduling software and other policy, procedure and practice tools such as cost estimates from prior projects.

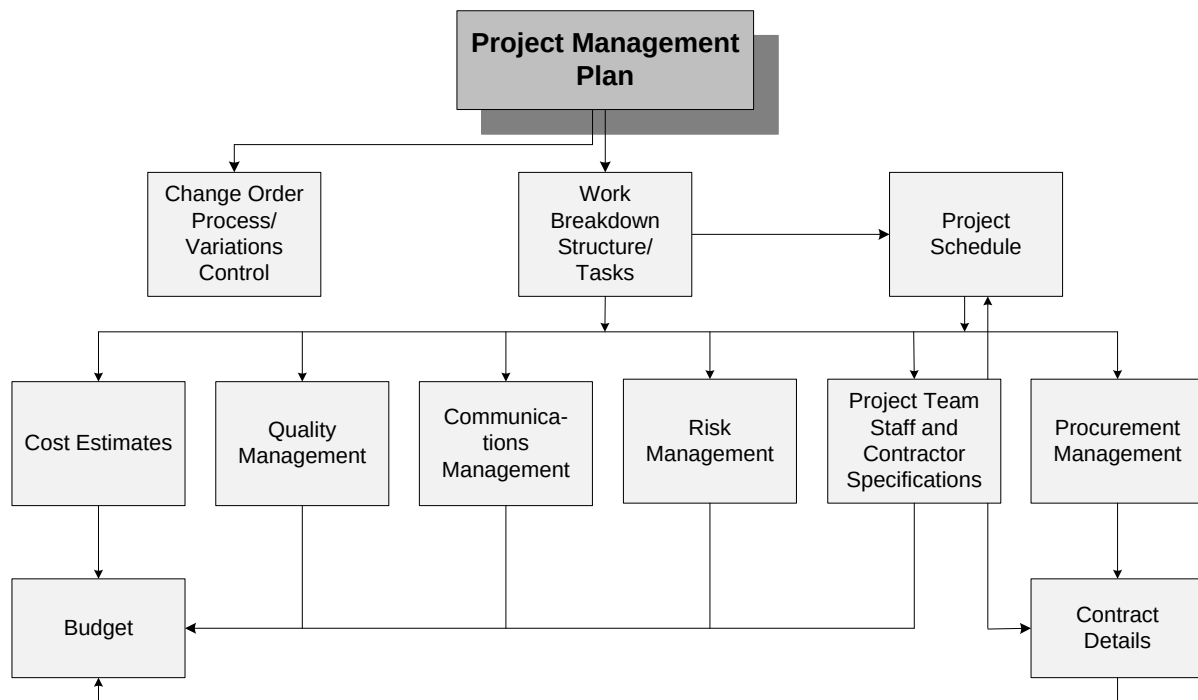


The project management plan continues to be refined throughout the planning process. Refinements could include incorporating approved changes or revealing constraints, risks, assumptions or requirements that need to be documented. The plan is not generated and shelved but becomes a script for project execution (Do), management (Check), controlling (Act) and closure (Close).

The project manager's primary task in project planning is integration or coordination of plan elements to form a cohesive project management plan. Development of one element usually affects the other elements. The project manager is responsible for ensuring that when a plan element is developed or changed, the effect of the change is reflected in the other parts of the plan.

Exhibit 4-48 shows the primary interdependencies between plan elements. For example, it shows that once project team staff and contractor specifications are settled, this may require updating the project schedule, contract details and the budget.

Exhibit 4-48: Interdependencies Among Project Management Plan Elements



Note that the work breakdown structure/task list is used as the basis for many other project elements, so it is developed first, but after this the other elements can be developed concurrently. Elements can also be developed

incrementally. For example, the budget is developed incrementally because it may need to be updated after each other element's costs become known.

A project management plan can be simple, but at a minimum it specifies project resources, generates a schedule and sets the sequence of tasks. The IFMA global job task analysis lists some of the benefits of investing time in the development of a project management plan:

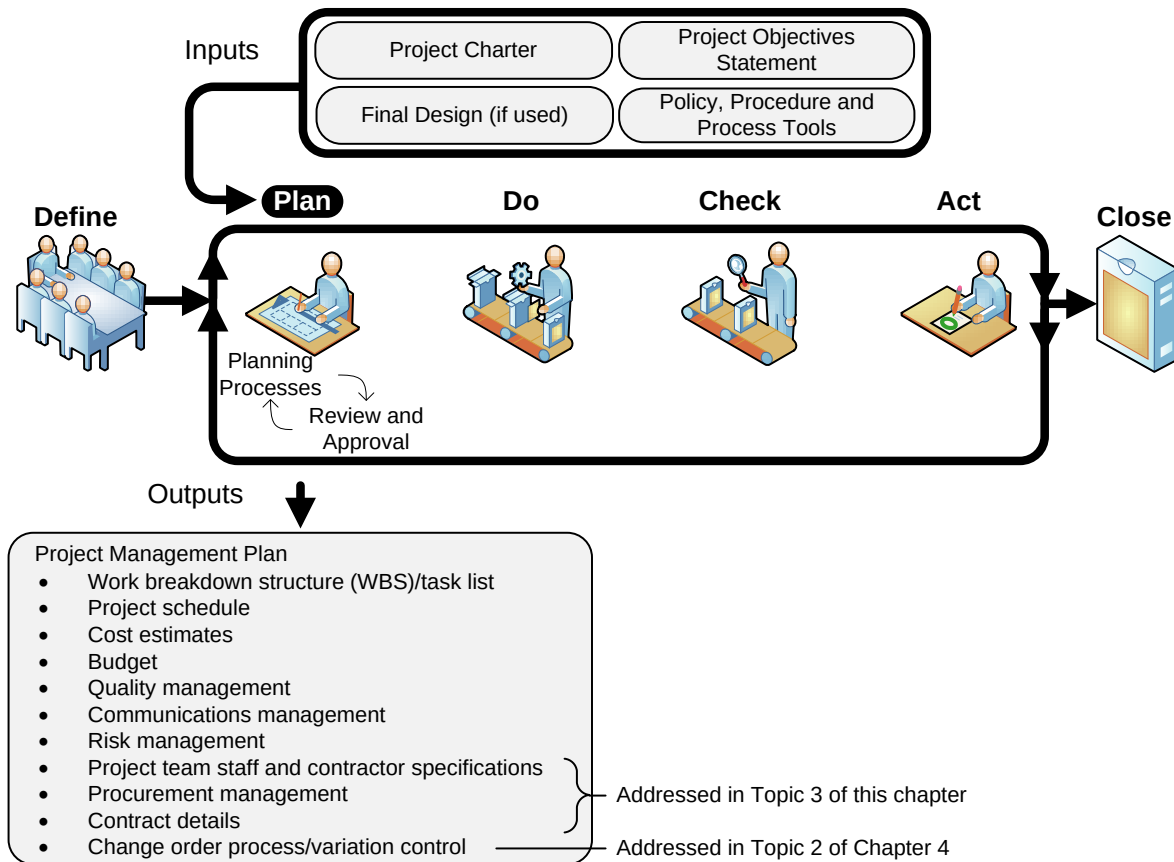
- Tasks requiring long lead times are identified and initiated to avoid delaying the project.
- Tasks contingent on other tasks (e.g., approvals) are sequenced appropriately.
- Potential risks are identified and steps to mitigate them are planned.
- The schedule accommodates the approved level of involvement by the project team and customer representatives.
- Costs are identified.
- The makeup of the project team is defined.
- Resources are scheduled.
- Principles of value engineering are practiced.
- Approval points, milestones and go/no-go decision points are defined to allow for project review, evaluation, postponement and cancellation.

Project planning bridges the gap between the statement of objectives (intent) and the development/execution of deliverables (results). The process of generating a project management plan involves both individual work and a series of team meetings. Exhibit 4-49 on the next page provides an overview of the inputs, planning processes and outputs for creating the project management plan.

As listed in Exhibit 4-49, project management plan elements discussed in this topic include the work breakdown structure/task list, the project schedule, cost estimates, the budget, quality management, communications management, and risk management. Project team staff and contractor specifications, procurement management and contract details are discussed in Topic 3 of this chapter, to highlight the importance of team and resource planning and contract details. The final element of a project management plan, the change order process/variations control, is discussed in Topic 2 of Chapter 4 because it primarily relates to project control. However, change or variation control still requires advance planning.



Exhibit 4-49: Inputs, Processes and Outputs for Creating Project Management Plan



Work breakdown structure/task list

A common checklist to show what needs to be done and who will do each task to accomplish project objectives is the work breakdown structure. A work breakdown structure (WBS) or task list is a method of dividing the project's deliverables and work into manageable or logical subdivisions so that the project scope can be defined and the required work can be understood and assigned. A WBS or task list is a hierarchy that branches out from the general to the specific and can be presented as an indented list or in a graphical format.

The list of tasks for a given project can be developed in many ways, including taking relevant tasks from a standard project format, using a prior WBS from a completed project, and/or by holding a project meeting.

In general, the process works by dividing the broad deliverables or major tasks into smaller amounts of work until they cannot (or should not) be further subdivided. This process of division may also be called decomposition.

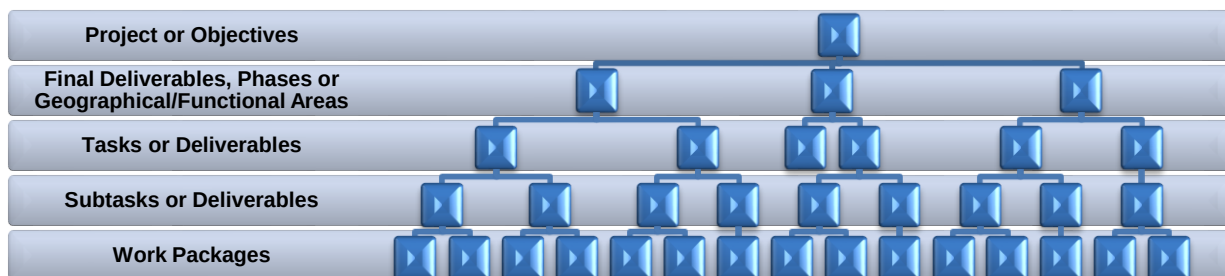


Smaller tasks can be more accurately estimated for duration and cost. Defining the unit of measure for scheduling can help determine the required level of detail. For example, planning by hours requires more detail than by days.

A WBS defers all sequencing until project scheduling, so team members need not place the tasks in a particular order at this stage. Scheduling too soon can result in an incorrect critical path because some important tasks could be omitted. Note that for smaller projects the WBS/task list and the schedule can be generated simultaneously using simple project scheduling software.

The indented list format for a WBS is a text-based outline that applies deeper levels of indentation to subdivisions of work. The graphical format for a WBS is shown in Exhibit 4-50. Definitions of the terms in the exhibit follow.

Exhibit 4-50: Work Breakdown Structure in Graphical Format



Definitions

Terminology related to a WBS includes the following:

- A **task** is a function to be performed that always consumes time and may consume resources. In contract proposals, a task is a unit of work that is sufficiently well defined so that, within the context of related tasks, readiness criteria, completion criteria, cost and schedule can all be determined. A task can also be called an activity.
- A **subtask** is a division of a task into units that are cohesive and relatively independent from each other.
- A **work package** is a deliverable or component of work that can be cost-estimated, scheduled and measured. It is a division of a subtask into the smallest unit of work defined in a WBS. A work package is assigned to an individual and contains enough detail to allow for work execution.



Process

Dividing tasks down to the level of the work package requires the developers to have a detailed understanding of the tasks, which may require expert judgment or developing the WBS on a phase-by-phase basis if later project phases are yet to be fully clarified or specialized team members are yet to join the team. The following steps are used in developing a WBS:

- **Divide tasks into subtasks.** The project manager holds a team meeting to identify, number and organize deliverables and high-level tasks into a hierarchical structure and split deliverables into major components. Subprojects, contract work and responsibilities may be identified.
- **Divide subtasks into work packages.** Project team members with specific expertise divide subtasks into activities that can be performed by an individual or cohesive group or that facilitate estimates of cost or time. The work packages indicate how the work is done and controlled.
- **Iterate and validate.** The WBS is used in part to determine project team requirements. Therefore, once the full project team is on board, team specialists review the WBS and revise or augment it as needed. They validate work packages by asking questions such as:
 - Do all tasks/subtasks/work packages begin with an action word?
 - Can a specialist determine the effort required to perform this task?
 - Does each task result in a deliverable?
 - Does this subdivision create unnecessary management or control steps or inefficient use of resources?

WBS dictionary

A WBS dictionary itemizes and describes work packages and includes details such as dependencies. It supports the indented list or graphical hierarchy and lists the following data for each work package (as data becomes available):

- A WBS code (ID code) that may indicate a task and a subtask (e.g., 5.2.2)
- Task name (a verb-noun combination)
- Details of the work to be done and scope limits to the work.
- Success criteria or completion criteria
- Schedule milestones
- Estimated cost
- Cross references to predecessors or dependencies, which are work packages that must be complete for work to start on the current work package
- Owner—individual responsible for execution and department for categorization (Note that if a team is assigned, the team leader is the responsible individual.)
- Person with control responsibility



Note that some data for a WBS dictionary is not added until later when it is known, such as data on predecessors or dependencies, which is determined when creating the project schedule.

Project schedule

A project schedule is a tool to organize tasks into a sequence with start and end dates for each task and assign responsibilities and resources. It may also link tasks by their predecessors or dependencies and communicate milestones and progress.

Process

There are many ways in which to build a project schedule. The following describes some common scheduling activities:

- **Determine resource availability and lead time.** Availability and lead time required to acquire team members, professional services, equipment, materials or other resources is determined or estimated.
- **Sequence tasks.** The tasks from the WBS/task list are placed in a logical sequence that identifies predecessors or dependencies (tasks that must be complete prior to starting the next task). An effective sequencing method is to arrange Post-it notes on a wall.
- **Estimate resources.** Team specialists create estimates of the resources (human resources, materials, opportunity costs) required for each task. Since an expert may perform a task faster than a novice, it is important to determine who will perform a task (and the person's availability).
- **Estimate duration.** Team specialists estimate of the duration of each task using data from past projects, expert judgment and estimation tools. Team meetings can be used to generate consensus on estimates. Failure to agree on an estimate may indicate that the task needs to be further broken down.
- **Build project schedule.** The project schedule is assembled from the sequencing and estimation tasks. Schedules may be built from the start or end of a project or by finding the critical path:
 - **Forward pass scheduling** is a schedule that takes tasks in sequential order in order to arrive at a realistic and reasonable completion date.
 - **Backward pass scheduling** begins with a fixed completion date and arranges necessary tasks in order to allow enough time to complete all the project tasks.
 - **Critical path scheduling** is based on identifying predecessors and time frames. Each process that requires a previous process to be completed before it can begin is entered in a time schedule so that the minimum time for overall project completion can be determined.



In all of the above types of scheduling, as many tasks as possible are concurrently performed, constrained by resource availability and predecessors. Forward pass scheduling is used when there is no hard deadline or to indicate the most realistic schedule. Backward pass scheduling is more difficult than forward pass scheduling but is useful for determining when a project should start based on a fixed completion date or hard deadline, for example, a lease termination date dictated by contract. Critical path scheduling is useful for identifying tasks that must be completed before the next task can begin. For example, if lead time on ordering carpet is miscalculated and the carpet is delivered late, the carpet degassing, carpet install, construction of movable walls and furniture, and moving of furniture will also be delayed. If contractors and movers cannot be rescheduled in time, they may charge for the days they were not needed.

Tools

Numerous tools exist to implement a schedule. Commonly used tools include Gantt charts (bar charts), network diagrams, the critical path method (CPM), and the program evaluation and review technique (PERT).

Gantt charts (bar charts)

Gantt charts or bar charts show a timeline that graphically illustrates the duration of tasks using bars. Milestones on the timeline are usually indicated with a diamond shape. Gantt charts also include information on dependencies/predecessors, usually using lines connecting one bar to another. Progress to date or the current date may be indicated by a line or color coding.

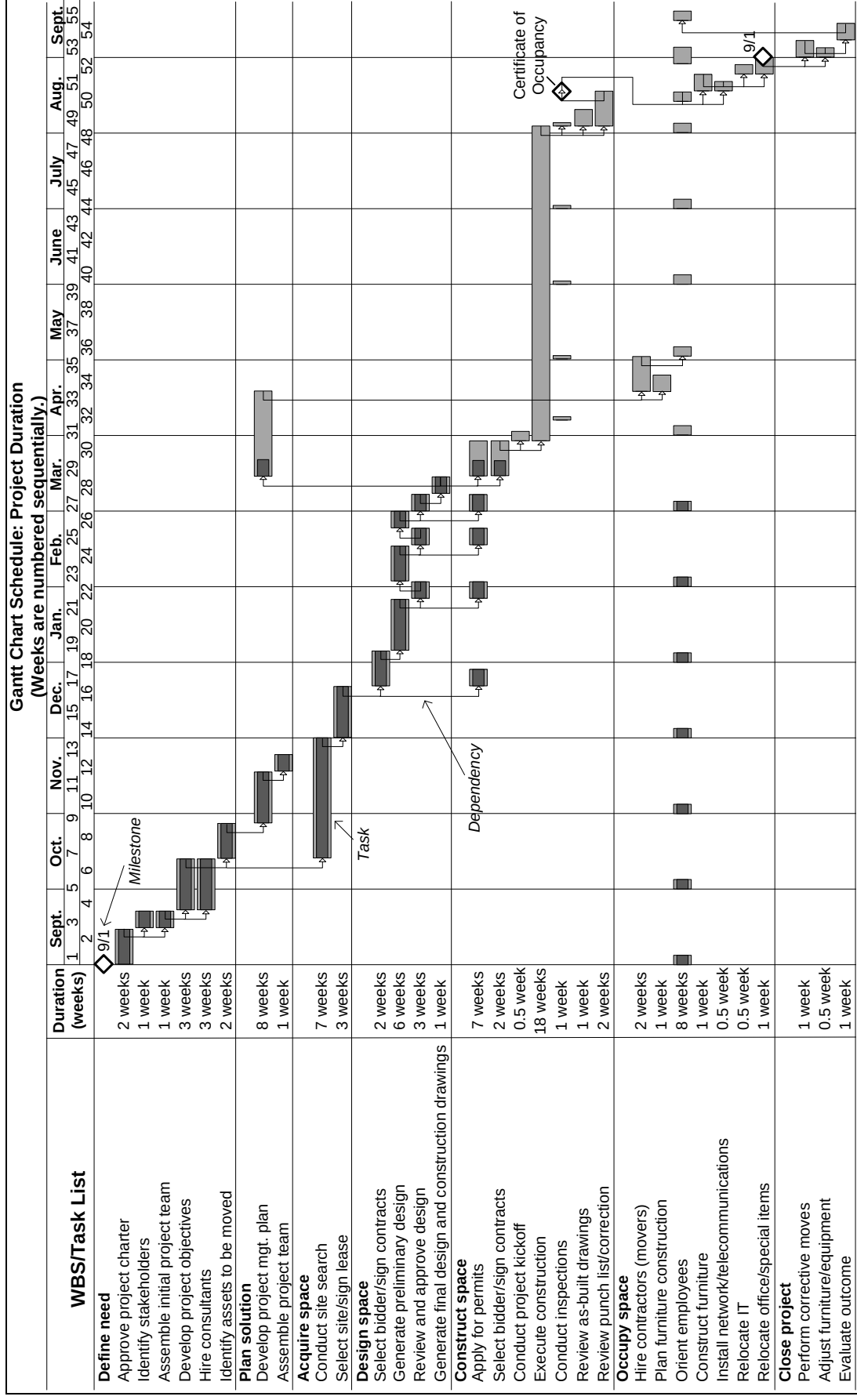
Many software packages automatically generate Gantt charts and other project schedule types based on a single set of inputs. Such systems automatically adjust items as needed when other parts of the schedule change (e.g., automatically adjusting all items on the critical path when a deadline is missed).

Gantt charts are frequently used in projects even if other methods are also used because they are easy to read and can present information at an executive overview level by showing only the major tasks and milestones. They can also be expanded to show detail down to the level of the work packages.

Exhibit 4-51 shows a Gantt chart for a relocation project at an executive overview level. The darker-shaded bars indicate progress to date. Milestones are marked by diamonds, and dependencies are shown using connecting lines.



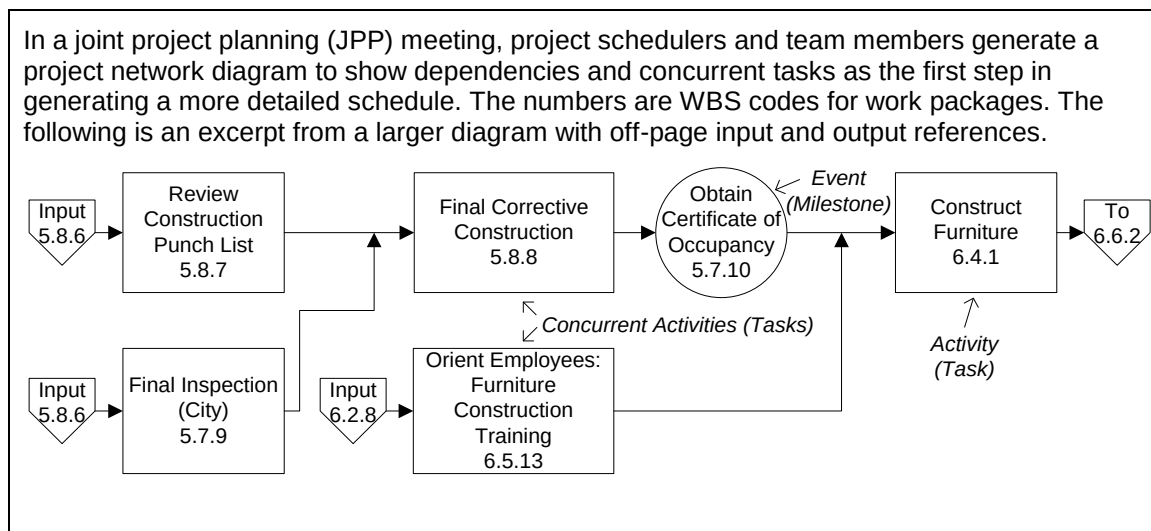
Exhibit 4-51: Sample Gantt Chart – Relocation Project



Network diagrams

Network diagrams are methods of graphically illustrating the sequence of events and activities (i.e., tasks). In network diagram terminology, events are singular points in time, such as milestones, and activities are processes that have a duration. Exhibit 4-52 shows a sample network diagram for the same relocation project. This type of network diagram is called an activity-on-node network. It uses boxes for activities (tasks) and circles for events, but events are not shown unless they are milestones. Activities that are parallel with each other occur concurrently.

Exhibit 4-52: Sample Network Diagram



The primary advantage of a network diagram is its ability to communicate simple dependencies and concurrent activities without unnecessary detail. The diagram's simplicity can be a disadvantage as well. For example, there is no way of knowing how long an activity (task) takes using a network diagram (unless it is modified to list duration, as is done in the critical path method).

Critical path method (CPM)

The critical path method (CPM) is a scheduling tool that uses forward pass scheduling followed by backward pass scheduling to determine a critical path for the project on a modified network diagram. The critical path is the longest set of sequential tasks in a project, which is the shortest possible planned project duration.



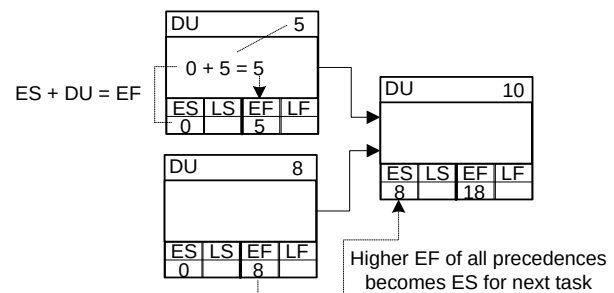
Typical steps in the critical path method include the following:

- **Step 1:** Using the WBS/task list, arrange tasks showing precedences (arrows) and record the duration (DU). Duration is an estimate of how long the task will take specified in weeks, days, hours, etc. The CPM box also contains time codes:

- **ES: Early start** is the soonest the task can begin.
- **LS: Late start** is the latest time the task can begin.
- **EF: Early finish** is the soonest the task can end.
- **LF: Late finish** is the latest time the task can end.

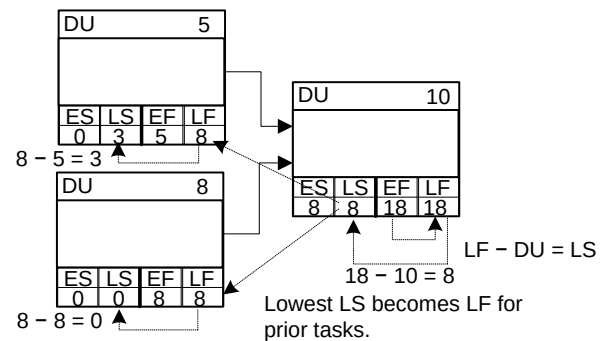
Duration (weeks) 3			
WBS Code (Task ID)			
Task Name			
ES	LS	EF	LF
0	2	3	5

- **Step 2:** Perform forward pass scheduling, starting at the beginning and going to the end. First, determine the early start



(ES) and early finish (EF) for each task successively. The early start for the first task in a project begins at 0. Add the amount from the early start to the task's duration to find its early finish. The next task's early start is the prior task's early finish. If a task has multiple precedences, the highest EF is used.

- **Step 3:** Perform backward pass scheduling, starting at the end and working back to the beginning. First, determine the late finish (LF) for the last task.



Note that if a project has a hard deadline, this is used as the late finish for the last task or the task's early finish can be used as its late finish. Next, subtract the task's duration from its late finish to find its late start (LS). For each task, the lowest late start value is entered as the prior activity's late finish.



Note that CPM scheduling using days as a measurement usually includes only workdays, so a calendar schedule will be of greater duration.

Note also that each task on the critical path has the same early start and late start ($ES = LS$) and the same early finish and late finish ($EF = LF$). In other words, delays to tasks on the critical path delay the final end date. Tasks not on the critical path have a gap, or slack, between estimated starts and finishes. Slack or float is leeway allowed for starting or ending noncritical tasks sooner or later without affecting the overall schedule. Knowing which tasks have slack and which do not is a primary benefit of CPM.

Exhibit 4-53 on the next page shows a sample critical path for the sample relocation project.

Program evaluation and review technique (PERT)

The program evaluation and review technique (PERT) is a critical path scheduling model that incorporates the main concepts and techniques of the critical path method but adds a probabilistic method of estimating duration and cost for each task. PERT incorporates probability by including an optimistic and pessimistic estimate but places the most weight on the most likely estimate.

PERT is most useful for projects with variable estimates or projects in which it is difficult to determine the percentage complete for phases (for example, a research project). PERT can aid in developing models for schedule or budget risk. The disadvantage of PERT is that it may be unnecessarily complex for many types of projects. PERT is not often used for construction projects because time and cost estimates are readily determined.

Documentation

The project manager or a scheduler is responsible for producing the overall project schedule and major milestones. When projects require professional services, these specialists are often responsible for producing their portion of the schedule. For example, on a construction project, design/engineering firms, the general contractor and subcontractors usually produce schedules. The project manager merges these schedules into the master schedule for the project.

Schedule documentation is adapted to the needs of each specific stakeholder. The master schedule can contain numerous details, but an executive may receive only a high-level Gantt chart and a particular team member with no training in reading a schedule may receive only a set of deadlines.

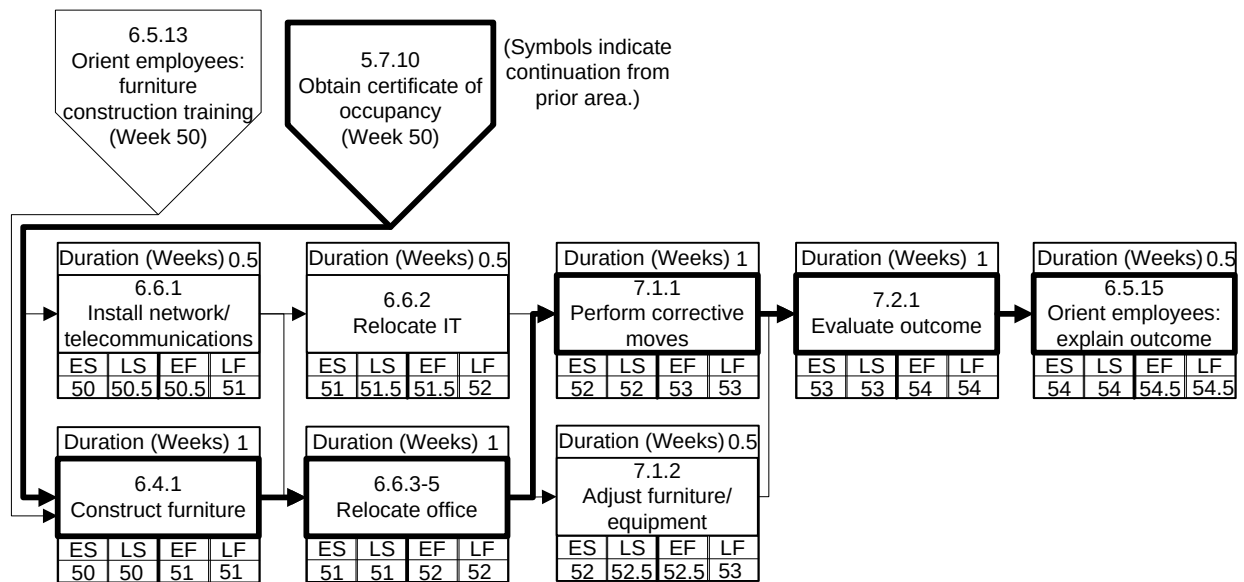


Exhibit 4-53: Sample Critical Path Method—Relocation Project

The hard relocation deadline of September 1, 20xx, is used to find the critical path for the relocation. The following data from the WBS dictionary is used to calculate the portion of the schedule that follows.

WBS Code	Task	Duration (Weeks)	Predecessor
6.6.1	Install network/telecommunications	0.5	Obtain certificate of occupancy (5.7.10)
6.4.1	Construct furniture	1	Obtain certificate of occupancy (5.7.10) Orient employees: furniture construction training (6.5.13)
6.6.2	Relocate IT	0.5	6.4.1, 6.6.1
6.6.3–5	Relocate office	1	6.4.1, 6.6.1
7.1.1	Perform corrective moves	1	6.6.2, 6.6.3–5
7.1.2	Adjust furniture/equipment	0.5	6.6.2, 6.6.3–5
7.2.1	Evaluate outcome	1	7.1.1, 7.1.2
6.5.15	Orient employees: review outcome	0.5	7.2.1

A partial network diagram using the prior data follows, showing the critical path in bold.



Cost estimates

Cost estimates are the foundation for the project budget and for cost control during project execution. To produce reliable cost estimates, a project needs estimators with appropriate expertise and specialization and a sound cost estimation policy.

Estimation policy was discussed as a policy input in Topic 1 of Chapter 2. Cost estimation policy may specify the use of standard published cost estimating guides and software tools. In addition, estimation policy usually addresses methods of avoiding overestimating costs, such as requiring the use of contingency reserves for unanticipated costs rather than building the cost into each uncertain task. Estimation policy specifies the amount of a contingency to apply to a given type of task.

Cost estimates need to account for the following types of costs for a task (some are charged to the project overall):

- Direct labor (work directly performed for a task)
- Administrative costs (indirect labor)
- Direct materials (materials directly consumed by a task)
- Indirect materials (peripheral or bulk materials, e.g., toner for printers)
- Hard costs
- Soft costs
- Equipment
- Services
- Overhead (cost of facility use, electricity, water, etc.)
- Financing costs

Cost estimating can be used as a planning tool. For example, an estimate can be made to determine the cost reduction if additional planning is performed, or estimators can perform life-cycle costing to estimate the total cost of a product or service over its lifetime.

When performing cost estimates, estimators survey the current prices for materials from their approved sources or the open market. They may also refer to organizational databases that list standard costs. Estimators refer to the project objectives statement to determine the grade or quality of materials or services to include in the estimates. Cost estimates are also closely tied to the schedule and project team and contractor specifications, for example, seasonal availability/cost of materials or availability of staff.



Methods and tools

Cost estimating methods and tools may include the following:

- **Historical.** Historical costs are adapted from similar prior projects. They are economical to gather but require expert judgment. Historical costs require inflation and/or geographic unit cost adjustments.
- **Bottom-up estimating.** Estimates start at the work package level and are summed up for subtask, task and project levels.
- **Top-down estimating.** Task-level estimates are used when work packages are insufficiently defined. Alternately, a hard budget is set at the top and costs are divided among the components.
- **Parametric modeling.** Cost per person-hour, square meter or foot, or another rate is gathered from provider quotes or historical costs. The rate is multiplied by the quantity of the resource used to form an estimate.
- **Evaluation of competitive bids.** Outsourced projects, tasks, subtasks and work packages can be estimated by reviewing submitted bids.

Documentation

The cost of the resources needed to complete each scheduled task is determined separately and recorded in the WBS dictionary for that task and possibly in a cost accounting system. Cost accounting systems may have codes to record the types of costs involved, for example, a code for labor costs. The documentation includes details on how the estimate was made as addressed previously in the discussion of estimation policy.

Budget

Cost estimates plus contingency reserves are aggregated into a budget, which is a baseline document for use in later project execution, monitoring and control. This budget clarifies and refines the high-level budget from the project objectives statement. As the project scope is refined during design/engineering and development of the project management plan, the budget is updated to reflect these scope changes. The budget is also updated as actual prices and costs are gathered. A budget derived from scope refinement and detailed cost estimation that differs significantly from what was previously defined is an important scope issue that needs to be communicated to and discussed with all stakeholders.

Development of the budget also requires close integration with the project schedule, because costs are allocated to the period in which they are incurred. Similarly, budget constraints can require changes to the project schedule such as completing a task more quickly to minimize financing costs.

It is important that the project manager understand the organization's or client's budget process and budget approval policy. There are situations in



which a project could have an approved budget but, due to the economy, merger activity, sales/revenue, or internal politics, the ability and authority to spend this approved budget could be restricted by management or the client.

In later iterations of the project management plan, budgeting is concerned with finalizing costs based on resource availability and other constraints.

Methods and tools

Budgeting methods and tools may include the following:

- **Reconciliation with funding priorities.** If a project's priorities express a not-to-exceed cost for the project and the estimated total exceeds the funding limit, the deliverable scope, time or quality needs alteration. If funds are released periodically, schedule adjustments may have some tasks with slack occur in different periods to smooth out incurred costs.
- **Project costing plan.** The project costing plan specifies how costs are applied. Costs are applied to a work package at the start of work (called front-end loading) or at the end (called back-end loading) or they are prorated.
- **Cost management plan.** Project managers create a plan for analyzing the variance between the budget and actual costs and set limits for what constitutes acceptable variance. Costs significantly over or under budget are investigated. Types of corrective actions are planned.
- **Budget change control process.** A process for reviewing and approving or denying changes to the budget is established.
- **Contingency reserve analysis.** Financial specialists analyze the adequacy of reserves set aside for unplanned but necessary project changes.

Documentation

The following may be included in documentation for budgets:

- **Project funding requirements.** A summary of estimated costs per period is compared to funding requirements to indicate funding shortfalls.
- **Master project budget.** The master project budget is a summary-level budget that expresses the work breakdown structure from a financial perspective. It may include costs for each of the following budgets:
 - **Project phase budgets or planning budgets.** These budgets break down costs by milestone or phase or hard versus soft costs.
 - **Direct labor budget.** A direct labor budget itemizes staff and contracted resource costs for the project team.



- **Administrative budget.** An administrative budget allocates a portion of the cost of executive and administrative salaries to the project.
- **Direct materials budget.** A direct materials budget itemizes the cost of materials that are directly used in deliverable creation.
- **Overhead budget.** An overhead budget allocates a portion of the cost of facilities, utilities and other general costs to the project.
- **Risk management budget.** A risk management budget itemizes costs of all project risk mitigation efforts, including insurance and bonding.
- **Quality control budget.** A quality control budget itemizes intended expenses for monitoring, testing and inspection, and controlling quality.
- **Contingency budgets.** A contingency budget indicates the amount of funds set aside for scope or schedule adjustments and other changes.

Small projects may not budget to this level of detail.

Quality management

Quality management has two goals: to create a plan to meet the overall scope of the project in terms of quality (i.e., deliverable features and level of effort to be expended) and to establish and maintain quality standards. Meeting the first goal requires understanding the difference between quality and grade:

- **Quality** is fitness for intended use.
- **Grade** is a method of classifying materials or deliverables that have the same functional use but differences in technical features or perceived value.

Quality management ensures that the grade of materials is appropriate for the intended use, as defined in the statement of requirements and the project objectives statement. The grade is neither greater nor less than what was intended. If costs need to be cut to fit a budget limit, quality management can ensure that the grade, not the quality, of materials or services is reduced in scope (i.e., simpler but has no known defects).

The second goal, establishing and maintaining quality standards, involves selecting appropriate quality standards, integrating them into plans, and monitoring team member and contractor compliance. Quality standards define minimum acceptable performance for a particular type of deliverable or process and provide methods and tools to monitor, test and inspect for compliance.

Quality tasks are integrated throughout the project management plan. They are included in the work breakdown structure, schedule, budgets and other elements.



For example, if quality is to be part of every team member's job, the communications plan addresses quality in meetings and communications.

When generating a quality management plan, project team members refer to applicable organizational policy on quality, determine if there are any government regulations or codes applicable to the project, specify required testing and inspection, generate a commissioning plan (if applicable), and use "lessons learned" information to justify quality expenses. The project objectives statement may also list constraints or risks that affect quality planning.

Methods and tools

Quality management methods and tools may include the following:

- **Cost-benefit analysis.** A cost-benefit analysis can determine if the benefit of tests related to quality exceeds the cost of performing those tests.
- **International quality standards.** Many sources of quality standards exist. The International Organization for Standardization (ISO) issues internationally recognized quality standards. Quality standards may provide tools and templates. ISO 10006, "Quality in Project Management," specifically addresses project management.
- **Total quality management (TQM).** TQM is a formal quality process that has an intense focus on the customer, involves all stakeholders, and employs continual improvement. FM projects could use selected elements of TQM.
- **Benchmarking.** The quality tools and lessons learned from prior projects that used the same metrics can help when planning quality management.
- **Cost of quality (COQ).** COQ measures the cost of quality by category: prevention of nonconformance to requirements, requirement conformance appraisals, and internal and external failures to meet requirements. COQ quantifies the observation that it is less costly to prevent errors than to correct them later through inspection.

Documentation

Documentation for quality management may include quality standards that apply to the project and acceptance criteria. Acceptance criteria are the metrics and checklists taken from the project's statement of requirements, success criteria and objectives that are required to be satisfied before a deliverable is approved.

- **Quality metrics** define how to measure a specific aspect of quality, such as failure rate or reliability.
- **Quality checklists** are methods of determining whether all required tasks in a process have been done.



Communications management

The purpose of communications management is to consult with or inform each stakeholder so that each receives:

- Neither too much nor too little project information.
- Information at the right time so that it can be useful for decision making.
- Either one-way (inform) or two-way (consult) communications.
- Communications in an appropriate media format and level of formality.

Giving the right amount of information at the right time to a stakeholder requires learning what the stakeholder needs to know to be effective. For example, executives generally do not want a high level of detail but do require frequent progress updates. If a project manager feels that executives are interfering in the project's management, it is often a symptom that they lack appropriate or timely information.

Communications management distinguishes between consulting and informing relationships. Some stakeholders are designated as persons with whom to consult on a given subject, while others are kept informed but are not asked for input. One way of designating who should be able to provide opinions on a subject and who should not is to place all stakeholders on a RACI chart. RACI stands for Responsible, Accountable, Consult and Inform, which are the four possible levels of interaction an individual can have with a given task. Project managers ensure that all parties understand and agree to their given role.

Communications management specifies appropriate communication channels for particular stakeholders. For example, plans may specify use of e-mail rather than phone or in-person visits to contact an expert who desires minimal interruption.

The level of formality in communications requires developing sensitivity to individual preferences and an awareness of what is appropriate in a given situation. Lack of formality when appropriate could reduce credibility, while too much formality with a project team could hinder team building.

Methods and tools

Methods and tools for developing communications management may include the following:

- **Online project management software.** Project teams can communicate and collaborate using online systems that can be password-protected to allow select information to be available to each user.



- **Meetings.** Meetings are of primary importance for many projects because they help establish consensus on issues. Meeting types include:
 - **Kickoff meetings.** Each time persons join the project team, a kickoff meeting can be used to introduce the project to the new members.
 - **Joint project planning (JPP).** JPP is a method of project planning that takes place in a series of meetings (one or two for each element of the project management plan). JPP can help generate consensus and increase estimation accuracy given adequate team preparations.
 - **Preconstruction meeting.** Construction projects require a preconstruction meeting between the customer, the project team, the general contractor and major subcontractors. The project manager leads the meeting and focuses on management of time and information through a detailed schedule review; he or she also addresses items of mutual concern for contractors and customers such as permits, the change order process, payments, progress inspections and trash removal.
 - **Regularly scheduled project meetings.** Project meetings are the primary way stakeholders are informed of project progress and issues. The project manager addresses problems, proposed solutions, resolution of prior issues, and schedule adjustments.
- **Meeting management techniques.** Meeting management involves:
 - Ensuring that the right attendees are at a meeting.
 - Holding attendees accountable for being prepared such as completion of required readings or promised deliverables.
 - Ensuring that the meeting stays on schedule and on subject.
 - Documenting and communicating the results of the meeting.

Documentation

The following may be included in documentation for communications management:

- **Format and media type used for each communication.** A detailed schedule of communications may specify:
 - Relationship, such as consult or inform, for each stakeholder.
 - Project team meeting schedule and format.
 - Project stakeholder status meeting schedule and format.
 - E-mail frequency and lists of persons to include in e-mails.
 - Virtual meeting frequency and format.
 - Persons responsible for distributing reports or information.



- **Conflict resolution communication process.** Informal and formal conflict resolution processes are defined and communicated to all parties.
- **Standard terminology used on the project.** A glossary of terms can reduce the chances of miscommunications.
- **Team contact lists.** Team contact lists are a directory of all team members and stakeholders, including contact information and preferences.

Risk management

Risk is the potential for the realization of unwanted, negative consequences of an event. It is the product of the conditional probability of an event and the event outcomes. Risk management addresses how risks are identified, assessed and managed during the course of the project. It is intended to prevent the following project problems:

- Conflicting priorities (e.g., highest quality at lowest cost and time)
- Project time/cost overruns
- Unacceptable quality deliverables
- Project failure

To prevent these and other failures, project team members prepare by studying the results of prior projects and performance records for or complaints lodged against current or prior contracted resources; they also analyze constraints such as the impact of the economic and social environment.

Process

The following are typical steps in the risk management process:

- **Risk identification.** Risk identification often involves a brainstorming meeting to list all of the potential project risks, for example:
 - Midproject scope changes.
 - Inaccurate time or cost estimates (underestimating is common).
 - Budget cuts or unrealistic deadlines.
 - Factors outside of team's control (e.g., material delays, bad weather).
 - Too few or unqualified team members.
 - High turnover or illness.
 - Morale issues or internal conflict.
 - Equipment failure or lack of equipment.
 - Material cost increases or unavailability.



- **Rate probability.** For each identified risk, planners arrive at a consensus on the probability of occurrence, often on a scale of 1 to 5 (low to high).
- **Rate severity.** For each identified risk, planners arrive at a consensus on the severity or impact on the project if the event were to occur, giving more weight to risks that affect the critical path or budget. This qualitative assessment uses the same scale as the probability rating.
- **Determine priority and perform quantitative analysis.** Teams prioritize risks based on the combination of probability and severity. Managing high probability, high severity risks increases the chances of project success.
- **Determine preventive strategy.** The team lists proactive actions available for reducing the likelihood or severity of risks that are within the team's power to enact given limited resources.
- **Determine contingency plan/strategy (risk mitigation).** For risk events that could occur regardless of preventive planning, contingent responses can be planned. Responses are planned only if a response can be implemented in time to make a difference. Contingent responses include:
 - Preapproved plan to extend a deadline or use a contingency reserve.
 - Tasks that can be delayed or cancelled if needed.
 - Best team members or backup personnel assigned to high-risk tasks.
- **Recovery plan.** A recovery plan is a fallback plan for a project to get the project back on track following an adverse event that could not be prevented or when the initial response was insufficient.

Methods and tools

Risk management methods and tools may include the following basic strategies for dealing with any identified risk:

- **Avoid**—clarify or change plans to omit the risk.
- **Accept**—do nothing (e.g., low risk/high response cost).
- **Transfer**—move the financial or resource effects of a risk to a third party (e.g., contractor or insurance). Note that it is difficult to transfer the schedule risk of tasks on the critical path.
- **Mitigate**—apply preventive measures to reduce probability and/or severity of identified risks.



Documentation

Documentation for risk management may include the following:

- **Risk register with red flags.** Project risks are included in a register that includes probability, severity, priority, results of quantitative analysis, likely root causes, and planned preventive responses for each risk. The register also lists red flags, or symptoms that a risk event is occurring, along with the appropriate contingent response.
- **Risk owners.** Risk owners are persons assigned to monitor risks, perform preventive tasks or initiate contingent responses to risks.
- **Risk management tasks and milestones.** Preventive risk management tasks and milestones are added to the project schedule.
- **Risk budget.** The risk budget ensures that risk responses are cost-effective. The percentage of the risk budget to spend on each risk item is tracked.
- **WBS elements affected by particular risks.** The work breakdown structure/task list is updated with the results of risk management.

* Topic 3: Plan Team and Resources

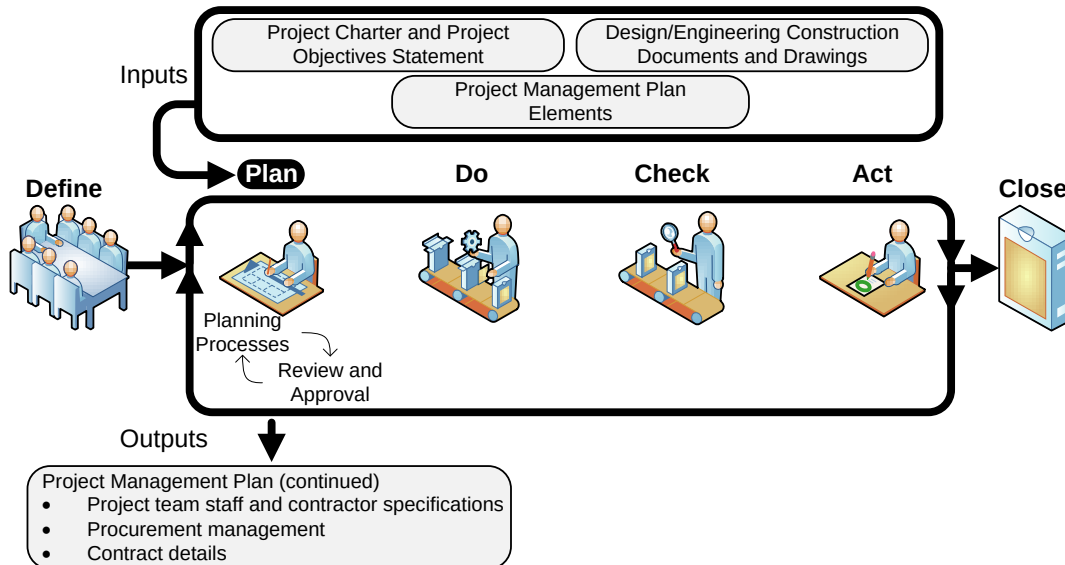
Planning the team and resources addresses organization and work assignment planning for internal staff and contracted resources assigned to a project. (Note that “contracted resources” is a term used in this competency to describe contracted project team members, material resource contracts, or professional services.) When developing plans for teams and resources, the scope and type of project strongly influences the type of team that will be needed, the amount of planning required to organize the team, and the amount of detail (and legal review) needed for contracts. There is a large difference in each of these details between service delivery projects, minor construction or alterations, and major construction or renovations.

Properly designing roles and organizing reporting structures optimizes the production capacity of the project team, improving performance and minimizing labor costs. Properly specifying procurement contracts for materials or professional services ensures that the right resources or services will be provided at the right time and at a fair price. The process of acquiring the team and resources is an important part of this activity; it is addressed in Topic 1 of Chapter 4. In some instances, staff or contracted resources are acquired first so they can participate in designing specifications or scope/statements of work (SOWs) for their role.



Exhibit 4-54 provides an overview of the inputs, processes and outputs of the Plan Team and Resources portion of the project management plan.

Exhibit 4-54: Inputs, Processes and Outputs for Planning Team and Resources



Inputs

Outputs from prior phases become inputs for planning the team and resources. As such, these inputs may include the project charter and the project objectives statement, design/engineering construction documents and drawings, and project management plan elements.

Project charter and project objectives statement

The project charter and the project objectives statement indicate the human and material resources required to complete the project according to its scope, schedule, budget and quality requirements.

Design/engineering construction documents and drawings

If architectural design or civil engineering construction documents and drawings are needed for a project, they become a direct input for the specifications or SOWs for a general contractor and subcontractors, for some project team members, and for procurement of materials.

Project management plan

Each part of the project management plan contains information that can be used when developing plans for the project team and resources:

- The **WBS/task list** provides details on the tasks, subtasks and work packages to be assigned to internal resources or contractors, including information on task complexity. The WBS is the primary input to the Plan Team and Resources process because it specifies the work that needs to be done and staffing and material requirements for each task.



- The **project schedule** provides deadlines for work. Time limitations may be the impetus for contracting out certain tasks.
- The **cost estimates** include staff versus contracted resource cost estimates and cost controls to stipulate in contracts.
- The **budget** includes the amount allocated for each position and task. Use of a contractor or accepting a higher negotiated fee for one position may require use of staff or spending less on other positions.
- **Quality management** identifies quality standards to stipulate and ways to measure compliance for staff and contractors.
- **Communications management** specifies meetings and communications points that form internal staff and contractors into a team. Contractually required communications may also be specified.
- **Risk management** includes the risks of nonperformance or underperformance of staff/contracted resources and the response to that risk (e.g., alternate staff, bonds, licensing, insurance, credentials).
- The **change order process/variations control** governs how changes are proposed and approved for staff work specifications or contracted resource scope/statements of work.

Processes and outputs

The Plan phase processes and outputs are discussed together because the processes are the means of producing the outputs. Exhibit 4-55 provides an overview of what is discussed in this topic.

Exhibit 4-55: Plan Team and Resources Processes and Outputs in Plan Phase

Project Team Staff and Contractor Specifications	Procurement Management	Contract Details
• Methods and tools • Documentation • Types of third-party staffing contracts • Stipulations of third-party staffing contracts	• Methods and tools • Construction contract models • Documentation • Material resource requirements • Professional services requirements	• Standardized contracts • Legal and expert review • Contract terminology • Bonds • Licensing • Insurance coverage • Necessary credentials • Special contractual relationships • Contractual constraints



Project team staff and contractor specifications

Project team staff and contractor specifications are the part of the project management plan in which the project manager generates the full set of team member roles and assigns the tasks each position will perform in the form of specifications for staff and scope/statements of work (SOWs) for contractors.

The goals of this process are to organize the project team roles/positions so that:

- The team is of sufficient size and makeup to complete all WBS tasks.
- The team roles represent all stakeholders.
- Each role specifies necessary skills and competencies.
- The number of positions needed for each role and when those positions start and end work on the project are defined.
- The reporting relationship among the roles is clearly communicated (e.g., organizational charts).
- The optimum mix of internal staff and contracted resources is used.
- Specific positions to be occupied by staff and by contractors are decided.
- Specific task responsibilities are assigned to each position in the form of specifications/SOWs.
- Plans for management are based on performance criteria specified in the tasks assigned to each position.

Project managers define roles for staff and contractors by assigning the work packages to each role. They group the work packages by similar requirements for technical and social skills and then divide the packages up among each planned position so that each individual will have an optimum workload throughout the project, avoiding times with either too much or too little work.

Some of the various roles on a project may include planners, schedulers, estimators, budget specialists, risk estimators, quality managers, or other roles to support the elements of the project management plan. On a small project, one person (possibly the project manager) could occupy several or all of these roles.

The bulk of the roles on a project are devoted to production of the project's deliverables, and these roles could include engineers, specialists, laborers, etc.

Another role for major projects is a project champion, occupied by a member of senior management or a client. The champion remains aware and involved during the project. He or she may attend only presentation/critical decision-



making meetings and is kept informed of progress, important issues and any conflicts. This person's status and authority often helps to ensure continued senior management/client support of a major project.

When deciding whether a position should be occupied by staff or a contractor, project managers need to understand the capabilities and availability of the staff members that they could select for the project team. Note that staff versus contractor decisions may be preliminarily decided and then revisited during the Acquire Teams and Resources process (Topic 1 of Chapter 4) because this is when staff/contractor availability is determined.

Methods and tools

Methods and tools for developing project team and contractor specifications may include the following:

- **Project organizational charts.** A project-specific organizational chart can be produced to identify team positions to be filled by internal staff/contractors and clarify reporting relationships.
- **Position descriptions.** Position descriptions can be used or created for complex roles and include qualifications, competencies, authority and responsibilities. They can be used to select or hire staff or contractors.
- **Project management office (PMO).** A PMO is software that provides an integrated performance-oriented view of the project and a central point of contact for teams. A PMO automates work authorizations and WBS task division by functional area or team role. PMOs track performance using a discussion and review forum and earned value metrics.
- **Communication and control.** Project managers communicate expectations and use the measurements specified in work packages to track performance.
- **Allocation of resources.** Project managers ensure that team members have exactly the required resources at their disposal at the right time.
- **RACI chart.** A RACI chart shows the task designations:
 - **Responsible**—the position/person who does the actual work
 - **Accountable**—the position/person who directs the responsible party, approves/rejects the work and is answerable for its success
 - **Consult**—the roles/persons who provide opinions and information in a two-way communication with the responsible party
 - **Inform**—the roles/persons who are updated on task progress



Documentation

Documentation for the project team and contractor specifications may include the following:

- **Roles and responsibilities.** Roles and responsibilities specify positions, authority, responsibility and competencies. Responsibilities could be prescriptive or results-oriented.
- **Staff and contractor acquisition plans.** For each role, the number of staff/contractors to acquire, work location, and cost per period are listed.
- **Staffing timetable with release criteria.** A staffing timetable schedules when staff/contractors start and finish work. Release criteria are metrics in work packages that must be met for work to be considered complete prior to staff/contractor release.
- **Human resource availability.** Individual availability is determined.
- **Regulation, policy and safety enforcement.** Relevant regulations, union contracts, policies, and safety goals and metrics are listed.

While general contract details are discussed later, at this point let's look at two categories of contract details specific to contracted team members: types of third-party staffing contracts and stipulations of third-party staffing contracts.

The following are types of contracts that are allowed for individual contractors or staffing organizations offering contract staff:

- **Fixed price.** The contractor is given a scope/statement of work and asked to submit a bid. The contractor is paid the agreed-upon amount regardless of how long it takes to complete the work.
- **Time and materials.** Time and materials contracts pay the contractor an hourly rate and reimburse them for materials documented by receipts.

The type of contract offered or negotiated depends on the amount of risk involved for both parties and on the relative availability of qualified contractors. If the work duration or scope is not clearly defined and/or contractors are scarce, contractors may not agree to a fixed price contract or may pad their estimates to reduce their risk. Fixed price contractors perform work only as stipulated in the contract. Additional work requires a change order and fee negotiation that is potentially more costly than a time and materials contract would have been. However, time and materials contracts generally offer less price stability for project budgets.



Stipulations of third-party staffing contracts include the following:

- **Compensation.** Terms of compensation for the contractor/contracting organization include the amount, timing and criteria for payments. Taxes and incentives may also be addressed:
 - **Taxes.** Contracts specify who is responsible for tax payments (usually the contractor).
 - **Incentives.** Recognition and rewards are clearly linked to objectives under the contractor's direct control.
- **Policy, procedure and practice.** Contracts may reference a set of regulations and policies that the contractor agrees to abide by upon signing the contract. The methods used to assess compliance are explicit. Key policy, procedure and practice elements include the following:
 - **Change orders and negotiation.** A process for negotiating and pricing work change orders is agreed to in advance.
 - **Safety.** Contractor safety measures are included in contracts not only to ensure the health and safety of contractors but to provide a legal defense if accidents occur and the contractor was not following safety measures. Contractors may be required to hold their own insurance.
 - **Employee/contractor parity.** Many countries have laws that require organizations to establish and monitor policies to ensure that employees and contractors are treated equally and contracting is not used as a means of bypassing employment laws such as fair hiring practices, disability access, age discrimination, parental rights, sickness and absence policy, leave entitlement, working time regulations, disciplinary and grievance procedures, and provisions relating to employment termination or redundancy/layoffs.

Procurement management

Procurement management is the element of the project management plan related to SOWs for purchasing materials or professional services. The project manager uses the work breakdown structure to itemize the required SOWs for the project. The SOWs list requirements for the type and quality of materials, the prescriptive processes, and/or results needed from services. The project manager uses subject matter experts to help develop the SOWs. Another key task in procurement management is to determine and track lead times. Lead time is addressed in Topic 1 of Chapter 4.



Procurement policy specifies who can arrange purchasing contracts, who reviews purchases, and who signs off on purchases. Management and legal review is addressed later. If procurement policy requires use of the organization's procurement department, project managers carefully manage this relationship to ensure that the procurement department properly prioritizes the project's procurement needs.

Although project managers can delegate responsibility for some or all of a project to an outsourced provider, they are still accountable for the results. For example, project managers contract out work that is beyond the organization's expertise but still learn enough about the process to exercise control or place someone on the project team who has the expertise. Project managers also conduct due diligence for parties that they work with to ensure, for example, that there is no conflict of interest between contractors and consultants.

Methods and tools

Most organizations use standard contract documents (e.g., AIA standard forms and contracts). Procurement policies usually specify types of contracts and guidelines for use. The guidelines may be based on a monetary limit, product or service complexity and/or the level of trust in the buyer-seller relationship. Types of procurement contracts include the following:

- **Fixed price (lump sum) contracts.** If there is no uncertainty in the cost, both parties agree to a price. Purchase orders are the simplest type; a purchase order specifies the raw material or product being purchased by quantity, price and delivery date.
- **Cost reimbursement contracts.** When costs are difficult to estimate in advance, the buyer can agree to reimburse the seller for actual costs plus a fee that is the seller's profit. The contract defines allowable costs and includes an audit mechanism. Indirect costs, such as administration and overhead, are often charged as a percentage of the direct material/labor costs. Cost reimbursement contracts include:
 - **Cost plus fee.** A percentage of the cost is agreed to as the fee.
 - **Cost plus fixed fee.** A fixed fee based on a cost estimate is agreed to in advance and altered only if the scope changes.
 - **Cost plus incentive fee.** Incentive fees can be designed to reward contractors for meeting cost, time or quality goals. Such contracts may promote continual improvement such as by sharing cost savings if the project is completed under budget.



- **Time and materials.** Time and materials contracts for procurement are open-ended like cost reimbursement contracts but have fixed prices as well, for example, using predetermined rates for material and labor.
- **Other contract vehicles.** A number of other contract vehicles exist and may have different names in different countries, for example:
 - Job order contracting (JOC).
 - Indefinite delivery/indefinite quantity (IDIQ) contracts.
 - Council of government (COG) contracts.
 - Blanket purchase agreements (BPA).
 - General Services Administration (GSA) multiple award schedules (MAS). (The GSA is a U.S. government agency.)

Construction contracts frequently use a contract model such as the following to organize project control.

- **Design-bid-build.** Construction bids are solicited after designs are complete, allowing for a fixed price contract at the start of construction. The owner can retain control of quality and operations and maintenance in designs. However, the process is time-consuming and the contractor is not available for consultation during design. Risks include conflicts with the general contractor (e.g., using only lowest-cost subcontractors).
- **Design-build.** The owner has a single contract with a firm (or a partnership of specialty firms with a proven ability to work together) that provides both design/engineering and construction services. This method is simple due to the single point of contact but has fewer independent checks and balances on contractor work.
- **Construction management.** The owner contracts with an independent construction manager who oversees and coordinates separate contracts with design/engineering firms and a construction firm. This consultant provides continuity and can engage a construction firm before designs are complete to minimize construction time, allow orders with a long lead time, and allow the construction firm to collaborate. The ambiguity in the construction contract due to lack of a design may reduce bid competitiveness, but the owner can open subcontracting to more bidders.
- **Multiple prime contracts approach.** The owner acts as the general contractor and directly retains all needed subcontractors. The owner can



fast-track the project by starting some work before designs are complete. The owner can reduce costs and fees, but since he or she is responsible for all scheduling and coordination, conflicts or errors could eliminate these savings. The organization can contract with an independent construction manager to reduce project risks.

- **PM at-risk or CM at-risk.** Project management (PM) at-risk or construction management (CM) at-risk is a contract relationship with a consultant who agrees to manage and complete a project within a guaranteed maximum price or absorb any cost difference. This consultant is therefore motivated to act in the owner's best interest. Often there are clauses to prevent exclusive use of low-bid contracts to meet the goal.

Documentation

Documentation for procurement management may include material resources requirements and professional services requirements.

The following are included in documentation for material resource requirements:

- **Specifications.** The specifications for the material being acquired are listed in sufficient detail and note any customization or installation requirements. Each specification lists the method to measure compliance/quality.
- **Milestones/delivery dates.** Ordering and delivery times are specified.
- **Authority level for purchase.** The purchase is signed off on by the appropriate authority, with reference to applicable purchasing criteria.
- **Updates to the project management plan.** Specific resources to be purchased are updated on the work breakdown structure, project schedule, cost estimates and budget.

Professional services requirements are requirements for a project or subproject that is outsourced. Professional services requirements are usually developed as an SOW that is progressively elaborated as the contractor is selected and the parties interact to coordinate a contract. Project managers use expert judgment to assess suggested alternatives or options and stated constraints.

Documentation for professional services requirements may include scope/statements of work. SOWs define the portion of the project scope



and work breakdown structure to be provided by the professional service, including deliverables and expected product support. Additional elements of SOWs include the following:

- **Job scope and description.** The scope of the work to be done and the deliverables are defined in sufficient detail for the work to proceed.
- **Schedule development and integration.** Documentation designates either internal schedulers or the professional service to develop the schedule for items listed in the SOW. Externally developed schedules list the approval and project schedule integration process to be used.
- **Coordination with multiple providers.** SOWs specify work that may be subcontracted and the general contractor's responsibility for subcontractor tasks, including coordination. SOWs also note points of coordination with other contractors or the project team.
- **Work breakdown structure updates.** SOWs may require that the professional service update the relevant portions of the WBS.
- **Permits.** Necessary permits and their required lead times are listed.
- **Procurement metrics.** SOWs specify how the products or results of services are assessed, such as the frequency and level of detail of performance, quality or cost data to submit.

Contract details

A contract is a written or oral agreement that creates an obligation between two or more parties and defines the details of that obligation. Contract details are usually preapproved standard boilerplate materials that the project manager simply attaches to the completed specification/SOW to form the contract. Other contract details are added a la carte or are customized. Contract details could apply to any of several types of contracted resources, including team members, material contracts or professional services. Contracts may also include legal or financial details such as those addressed in the *Finance and Business* competency.

Facility managers acting as project managers or their delegates to this role can benefit from a high-level understanding of contract details to select among options or to ensure that necessary components are in place.



The following are excerpts from the global job task analysis that indicate some of the information included in contract details:

- Criteria for selection are explicit and satisfy the project requirements.
- Bidding processes comply with health and safety requirements, equal opportunities (fair hiring), labor laws, environmental practices and other regulatory and management requirements.
- Special requirements are explicit:
 - Bonds
 - Licensing
 - Insurance coverage
 - Credentials for handling special equipment, materials, substances, etc.
- Non-typical contractual relationships among members of the project team are explicit.
- Not-in-contract (NIC); owner-furnished, contractor-installed (OFCI); and owner-furnished, owner-installed (OFOI) items are clearly identified.
- Non-typical materials or installation methods are clearly defined.
- All bid documents are subjected to the appropriate review and approval process (such as legal review).

The remainder of this topic takes a closer look at some of these contract details.

Standardized contracts

Most organizations specify the use of standardized contracts or contract details whenever possible. Organizations can produce their own standard forms or use internationally accepted standard contracts and forms such as those offered by the American Institute of Architects. AIA standard forms and contract documents are generally accepted by both parties in a transaction and are designed to allow organizations to customize them.

Having standardized contract details provides advantages such as:

- Reducing the risk of contract loopholes, contract fraud or lawsuits.
- Reducing legal department review costs.
- Minimizing time by:
 - Reducing or eliminating the time for contract language negotiations.
 - Leveraging standard contracts predesigned for a particular use or type of contracted resource.



- Following policies of the entire organization, for example, fair hiring practices.
- Offering continual improvement such as being simple and concise.
- Making cost and schedule prominent and controllable.
- Acting as a checklist, for example, ensuring that each contract has an end date.
- Making contracts comparable for bid reviews and benchmarking of past versus present contracts.

Legal and expert review

Contracts are legally binding documents for both parties, meaning that either party can take recourse in court. Therefore, the project manager is accountable for the contents of contracts, including contract details. Project managers read all contracts and can require independent contract reviews to gain assurance that contract details are appropriate:

- Legal review of contract details is performed once for standard boilerplate materials and at each occurrence of a la carte or customized contracts.
- Risk management representatives determine the need for contract details that transfer risk and assess whether contracts provide the right amount of risk transfer at an acceptable cost.

Contract terminology

While some important contract terminology is presented here, note that the only definition of a contract detail that is relevant is the definition contained within the contract itself. Definitions from any other source could differ. The following is some terminology relevant primarily to construction contracts:

- The **contract time** or **period of performance** is the period of time set forth for completion of construction.
- **Change orders** are a process by which modifications to the project scope, schedule and cost are made. A change order is the written document signed by the contractor, designer and owner that allows for changes involving cost and time.
- **Substantial completion** or **practical completion** is a clearly defined checkpoint in construction where the building or renovated space is ready for occupancy with only minor punch-list items to be completed.
- A **punch list** or **snagging list** is a list of deficiencies or incomplete or unacceptable work items compiled by the project manager, architect, engineers and/or designers during final inspection of the project.
- The **completion date** or **final completion** is a clearly defined date when the project is 100 percent complete, including all of the punch-list items.



- **Work** is the construction, equipment and services described in the construction documents to be provided by the contractor.
- **Incentives** or **penalties** are contractually specified monetary inducements or fines linked to specific performance measurements and may include some form of profit/loss sharing.
- **Liquidated damages** are an amount of damages on a daily basis specified in the contract. This amount will be assessed against the contractor for each day beyond the contract completion date that the project remains uncompleted.
- The **maintenance period** is a time period in which the contractor provides routine maintenance services for a deliverable as part of the contract.
- The **warranty period** is a time period in which a promise or guarantee of quality workmanship or deliverable quality is enforceable.
- The **period for honoring certificates for payment** is a time period in which invoices for contractor payment will be honored.
- **Limit of retention/retainage** is the longest time period in which money can be held back for paying a contractor for rendered services to ensure that all subcontractors have been paid.

Bonds

A bond is a certificate that promises to pay the holder a specified amount of money at some future date. Bonds are a risk transfer tool employed when the benefit of transferring the risk to another party outweighs the cost of the bond. The benefit is a reduction in risk as determined by risk management. Bonds can also be used as incentives to ensure proper behavior on the part of contractors.

Types of bonds that could apply to contracted resources include the following:

- A **bid bond** is a bond or cashier's check that bidders provide to customers along with a bid for a capital project to prove that the bid is in earnest and the firm has sufficient capital resources and will provide a performance bond if the bid is chosen. Bid bonds are callable (exercised) only when a contract is awarded but the bidder fails to perform under the terms in the bid. Bid bonds are often for 1 percent of the bid value.
- A **performance bond** or **surety bond** is a bond issued by an insurance company or bank on behalf of a contractor that guarantees that the contractor will perform the contract or that, in the event of default, the surety (party assuming the debt obligation) will either complete the contract or pay monetary damages up to the bond limit. Performance bond cost



usually ranges from 0.25 to 1 percent of a project's estimated cost, so these bonds could be omitted when using trusted contractors or on minor projects.

- A **payment bond** is a bond issued by an insurance company or bank on behalf of a general contractor that guarantees payment to all subcontractors and material suppliers if work is completed within the referenced contract's set terms and conditions or that, in the event of default, the surety will make the required payments so the project will be free of any liens at completion.

Licensing

Licensing is the permission to execute a project as granted by local authorities or the act of granting a license that is mandatory for practicing a profession or service in a specific region. Licenses are granted by an authorized government agency or an accredited board representing the consensus of that profession's community.

If a project requires services that can be performed only by a licensed individual or company—for example, engineering or construction—contract details include this requirement. Sometimes, work must exceed a certain cost threshold before a licensed professional is required.

Insurance coverage

Insurance transfers the risk of the insured events to the insurance company. Organizations that contract out work are still liable for the results of the work and for injuries to workers unless the contractors possess suitable insurance. Therefore, contracts require all bid winners to provide an insurance binder or certificate of insurance for each type of insurance that is required:

- A cover letter or insurance binder is temporary evidence of insurance.
- A certificate of insurance is a document from the insurance company that verifies insurance coverage for contractors on larger jobs. It includes dates that coverage is in effect and the dollar limits and types of the coverage.

The primary type of required insurance is liability insurance. Liability insurance protects the insured against lawsuits brought in response to supposed acts of negligence that result in injury or loss of property to the public. Types of liability insurance include:

- Workers' compensation for work-related injuries.
- Employer's liability for protection from employee lawsuits.
- Commercial general liability (CGL) for construction defects protection.



- Professional liability for facility managers, architects/designers or engineering professionals.
- Environmental liability insurance for environmental lawsuit protection.
- Umbrella liability for liability payments in excess of standard coverage.

Necessary credentials

Credentials are documents that prove the identity of a contractor or organization. Proof of identity is a vital control because it reduces the risk of misrepresentation by contractors.

Credentials may also refer to certifications to practice a particular profession or specialty. Credentials or certificates related to professional practices are similar to licenses except that credentials/certificates are not generally legally required unless part of a relevant permit or code.

A contract can still require that contracted resources possess one of several allowed credentials/certificates, especially if the task involves specialized or potentially dangerous equipment or materials. For example, to comply with health and safety requirements and labor laws, a contract for renovation could specify use of credentialed asbestos contractors.

Special contractual relationships

Contracts clearly identify what the contractor is responsible for and what is addressed under special contractual relationships. Special contractual relationships include the following:

- **Non-typical contractual relationships among project team members.** Non-typical contractual relationships can specify nontraditional accountability and control relationships, such as having a singular agreement with a design/build firm in which the design firm is a subconsultant to the general contractor rather than an independent contractor.
- **Not-in-contract (NIC).** NIC items are included in diagrams or documents for reference but are not part of the final deliverable. Items are marked NIC to indicate that they are not the contractor's responsibility.
- **Owner-furnished, contractor-installed (OFCI).** OFCI items are those that the owner purchases or already owns but the contractor is asked to install. Contractors can include just the installation costs in bids but may require that the owner assume liability for the item. Both the suppliers and



installers of owner-furnished items need to be included in preconstruction and appropriate progress meetings.

- **Owner-furnished, owner-installed (OFOI).** OFOI items are like NIC items except that the contractor may need to account for them in designs and the project schedule. For example, locks and the security system may be part of a separate contract. General contractors need to know any preparation work they are responsible for, such as utility boxes, and when the security contractor needs access to the site.
- **Non-typical materials or installation methods.** Contracts may specify use of particular materials or installation methods preferred by the owner. If bidders are encouraged to suggest options, such as alternate materials or methods, there should be a section for alternates following the base bid so that the bids remain comparable but contractors can be differentiated.

Contractual constraints

Contractual constraints are other stipulations for contracted resources or the seller that govern their behavior during and after a project. For example:

- A **nondisclosure agreement** is a legally enforceable contract or clause that requires the contracted resource to treat specified intellectual property as proprietary and not share it with others.
- **Indemnification** is a clause stating that the owner (officers, directors, employees, etc.) is “held harmless” from any damages or claims resulting from the construction project. Indemnification may require use of bonds or professional liability insurance to be enforceable.



Progress Check Questions

Directions: Read each question and respond in the space provided. Answers and page references follow the questions.

1. Place the following steps involved in acquiring and designing a space in the correct order.

()	a. Contract with design/engineering firms.	_____
()	b. Generate final design.	_____
()	c. Acquire space.	_____
()	d. Review and approve design.	_____

2. When acquiring space, which of the following tasks is used to combine occupant requirements, desired location, desired cost per square meter (square foot), desired floor plan/stacking plan and desired amenities to find an optimum location?

()	a. Conduct site search.	
()	b. Create site selection criteria.	
()	c. Conduct building evaluation.	
()	d. Generate a test fit.	

3. Which of the following types of drawings would probably be used in the design phase for line managers who want to see the layout of their department?

()	a. Engineering construction drawings	
()	b. Architectural construction drawings	
()	c. As-built drawings	
()	d. Schematic drawings	

4. Which of the following is a cost estimation method that takes cost per person-hour, square meter or foot from provider quotes and historical costs and then multiplies this rate by the quantity of the resource?

()	a. Parametric modeling	
()	b. Bottom-up estimating	
()	c. Top-down estimating	
()	d. Historical cost estimating	

5. Which of the following elements of a project management plan requires inputs from almost all other project plan elements before it can be considered complete?

()	a. Cost estimates	
()	b. Budget	
()	c. Quality management	
()	d. Risk management	



6. Which of the following types of scheduling tools uses both forward and backward pass scheduling and combines optimistic, most likely and pessimistic duration estimates for each task?
- ☐ a. Bar charts
 - ☐ b. Network diagrams
 - ☐ c. Critical path method
 - ☐ d. Program evaluation and review technique
7. Refer to the following RACI chart. If Item 4a was unacceptable to the finance department, who would senior management need to discuss this issue with and, if warranted, possibly issue a reprimand to?

Task	Team Member				
	Ho Kim, Project Manager	Rick Dunn, Programmer	Ralph Krum, Finance Lead	Jo Legler, IT Lead	Don Smith, Finance Staff
4a—Plan finance space	A	R	C	C	I

- ☐ a. Ho Kim
 - ☐ b. Rick Dunn
 - ☐ c. Ralph Krum
 - ☐ d. Don Smith
8. A project manager is developing project team and contractor specifications that include a scope/statement of work down to the level of detail found in a work package. Which of the following resources would he use?
- ☐ a. Project schedule
 - ☐ b. Procurement management
 - ☐ c. Work breakdown structure
 - ☐ d. Communications management
9. In which of the following construction contract models are construction bids solicited after designs are complete so that a fixed price contract can be arranged from the start?
- ☐ a. Design-bid-build
 - ☐ b. Design-build
 - ☐ c. Construction management
 - ☐ d. Multiple prime contracts approach
10. Which of the following is returned to contractors who submit proposals that are not accepted?
- ☐ a. Bid bond
 - ☐ b. Performance bond
 - ☐ c. Surety bond
 - ☐ d. Payment bond



Progress check answers

1. a-2, b-4, c-1, d-3 (p. 4-187)
2. b (p. 4-188)
3. d (p. 4-191)
4. a (p. 4-205)
5. b (p. 4-192)
6. d (p. 4-202)
7. a (p. 4-217)
8. c (p. 4-214)
9. a (p. 4-221)
10. a (p. 4-226)



Chapter 4: Manage and Oversee Projects

After completing this chapter, students will be able to:

- Recognize the need to check availability for internal staff or contracted resources and lead times for materials.
 - Understand how to select or negotiate with line managers for internal staff.
 - Indicate how to acquire contracted resources for team positions, materials or professional services using an open tender/bidding process or direct negotiation.
 - Understand the basic features of standard tender/bidding contracts and proposal responses.
 - Integrate or coordinate the work of project team members to ensure that schedules and tasks are orchestrated to maximize the efficiency and effectiveness of teams and resources.
 - Execute and control project activities according to the project management plan, including project scope, schedule, cost, quality, teams, communications, risks and project changes.
 - Understand the importance of minimizing midproject change.
-

✦ Topic 1: Acquire Team and Resources

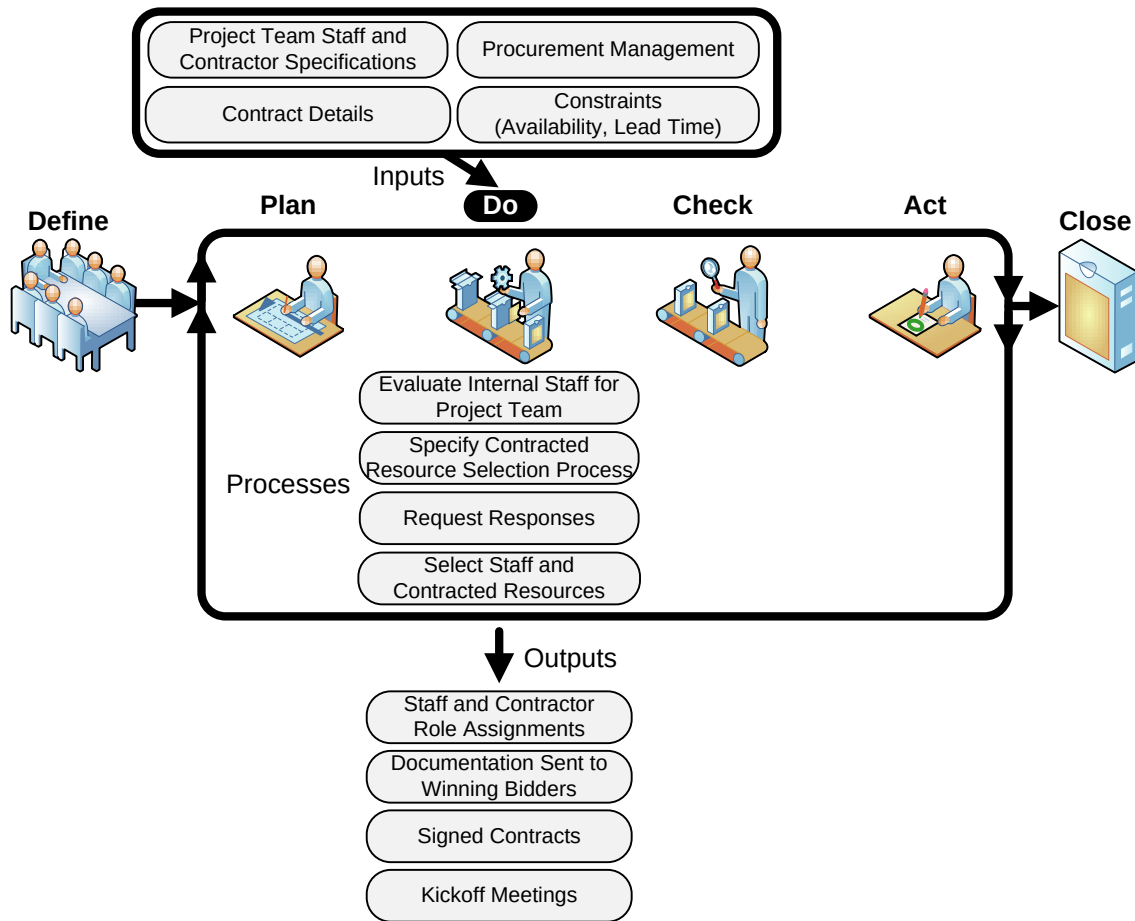
The quality and dependability of internal staff and contracted resources are important to any project, because people, materials and professional services strongly influence whether project objectives will be satisfied and whether the project will be considered successful as measured by scope and quality of deliverables, timeliness of results and ability to stay on budget. In other words, projects can be successful only if the project manager and the project team are selected and utilized successfully.

Project managers acquire the team and resources by selecting members from their own FM organization, negotiating with line managers for other staff, soliciting and accepting open tenders/bids for contracts, or directly negotiating contracts as appropriate. This process occurs on an as-needed basis throughout the project so that staff and contractors, professional services and material resources are available at the right time.

Exhibit 4-56 shows the inputs, processes and outputs for acquiring the team and resources.



Exhibit 4-56: Inputs, Processes and Outputs for Acquiring Team and Resources



Inputs

Inputs to acquiring the team and resources may include:

- Project team staff and contractor specifications.
- Procurement management.
- Contract details.
- Constraints, including availability and lead time.

Note that the process of acquiring the team and resources may occur for some staff/contracted resources before the process of planning the team and resources (Topic 3 of Chapter 3). In that event, the staff member/contracted resource may consult on the specifications or scope/statements of work for their position.

Other inputs may include:

- Policy, procedure and practice tools such as fair hiring/contracting practices and position descriptions.
- Project resources such as performance reports for staff/previously used contractors.

As noted above, constraints related to internal team members and contracted resources include availability and lead time issues. Availability refers to the ability of a candidate for a position or contract to be ready to start when needed and have sufficient time to devote to project tasks for his or her portion of the project. Lead time is the delay between when materials or services are requested and when they are available at the right time and place, including time for tender/bid processes, selection, contractor execution or production, and transportation.

The project manager verifies that availability and lead time are reflected in the work breakdown structure/task list and schedule and considers their impact when setting start and end dates for team members and professional services or order lead times for material resources.

Other constraints related to acquiring staff or contracted resources may include:

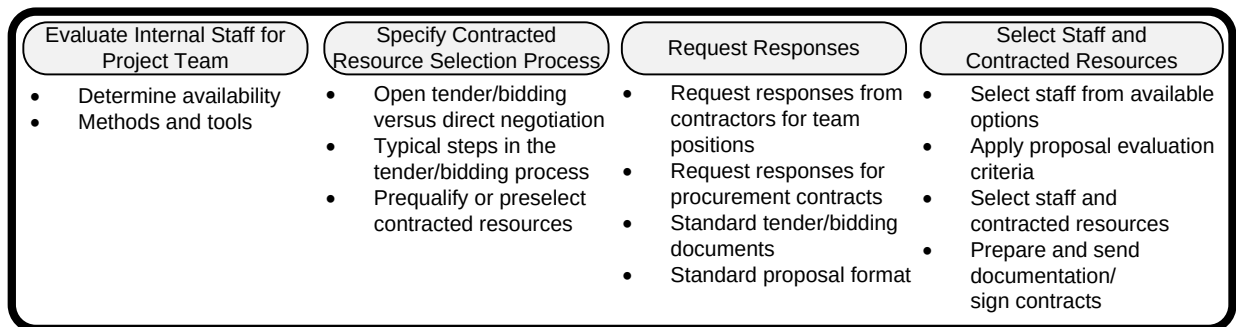
- Interdepartmental relationships if departments are involved.
- Informal power, influence and goals of prospective team members.
- Authority level of project manager to acquire staff from other departments. (Department heads may have final say in assignments.)
- Union agreements on changing job assignments for union employees.
- Allowed/expected amount of overtime.

Processes

In this topic, the processes involved in acquiring the team and resources are discussed only as they specifically relate to project management. The *Finance and Business* competency more fully addresses the tender/bidding process.

Exhibit 4-57 provides an overview of the Do phase processes discussed in this topic.

Exhibit 4-57: Acquire Team and Resources Processes in the Do Phase



Evaluate internal staff for project team

When evaluating potential internal staff members for a project team, project managers look for technical proficiency for the required tasks and for the ability to collaborate and get along with other team members. If these goals can be satisfied, project managers also consider individual career goals or desired areas of focus, if they can be accommodated. Assigning qualified team members to tasks fitting their interests helps foster team member commitment and sets a tone that the project manager is willing to accept input.

Determine availability

Project managers determine which qualified staff members could potentially be made available for a relevant portion of the project and which persons are unavailable (e.g., non-negotiable scheduling conflicts). Some larger organizations use online social networking tools to allow staff members to post information on their skills and availability.

Because project managers traditionally occupy staff roles, they may be able to request resources, but line managers/department leads generally have authority over assignments for their staff and decide which resources to release. Line managers may be inclined to assign individuals based more on availability than on fit. Project managers use soft skills such as negotiation and influence to acquire individuals with appropriate skills.

When working with staff that is assigned to a project part time, project managers work with the person's line manager to ensure that conflict between regular duties and project duties is minimized and that the team member will be able to meet project time commitments.

Methods and tools

Methods and tools for obtaining the project team may include the following:

- **Organizational charts.** Project managers can use an organization's existing organizational charts to determine who can have a team member released for the project and note any dual reporting relationships such as those created when a project team member reports to the project manager and a line manager. (Such matrix structures are addressed in the *Leadership and Strategy* competency).
- **Staff assignment negotiation.** Project managers may need to negotiate for staff from line managers or other project managers.
- **Hiring.** Project managers may be able to hire staff if the role will be ongoing after project completion.
- **Remote team members.** The project may be able to accommodate team members who work in remote branches, on different shifts or from home.



Specify contracted resource selection process

Organizational policy specifies the selection process to use for each contract team position, material resource contract and professional service contract. Selection processes usually name who can approve contracts within a price range and specify the type of selection process to use. Several levels of ranges may be specified. At the lower levels the project manager or a middle manager may approve minor contracts, while at the highest levels a senior executive is named as the approver.

In addition to naming who will sign off on contracts, standard selection processes may specify open tender/bidding versus direct negotiation, tender/bidding process steps, and prequalifying or preselecting contracted resources.

Open tender/bidding versus direct negotiation

Basic ways that contracted resources can be selected include:

- Open tender/bidding or competitive bidding.
- Direct negotiation contracts.

Open tender/bidding or competitive bidding is the process where multiple contractors are invited to tender/bid on a project so that the owner can maximize market pricing and achieve the desired project at the lowest possible cost. Open tender or open bidding processes are the most frequent method by which contracted resources are selected for a project; in many cases, it is required by organizational policy either in general, for contracts above a certain value, or to comply with legal requirements for certain government contracts.

Direct negotiation is a method for awarding a contract where a single contractor is subject to negotiation and receives a direct award of contract or a small group of selected bidders is subject to negotiation to award the contract. It can be used to compress the overall project duration by omitting the bidding process. However, without other bids, it is difficult to determine whether the project was competitively priced. Contractors for direct negotiation are chosen:

- Due to a positive past working relationship.
- By recommendation, e.g., from an architect or owner.
- As part of a prior preselection process.

Tender/bidding process steps

The steps in the tender/bidding process vary by organizational standards and the type and complexity of the contract being awarded. For example, the



tender/bidding process for capital construction projects typically consists of the following steps:

- Complete the project objectives statement and design documents, including architectural and engineering construction documents.
- Prequalify a list of general contractors and subcontractors.
- Request responses from contracted resources:
 - Set a deadline for response and a bid bond amount.
 - Conduct a pre-bid meeting at the construction site to orient bidders.
- Select contracted resources:
 - Collect and evaluate bids.
 - Request bidder presentations from a short list of finalists.
 - Make contractor selections.
 - Conduct final negotiations.
- Prepare and send documentation/sign contracts:
 - Issue a letter of intent (defined later in this topic).
 - Prepare and award the contract.

Prequalifying or preselecting contracted resources

Prequalifying or preselecting contracted resources can save time and money if one or the other is allowed. It can also be used as a project control, for example, requiring a general contractor to use preselected subcontractors.

Prequalifying contracted resources narrows the candidates who can respond to a tender/bid offer by setting prerequisites such as years of experience, litigation history, financial status, or use of bid, performance and payment bonds.

When preselecting contracted resources the project manager sends out requests only to specific contractors who have been predetermined to be acceptable. The list could be compiled as its own project or be a list of successfully utilized contractors.

Request responses Requesting responses from a (possibly prequalified) list of contracted resources determines the availability and interest of contractors to supply goods or services. Responses from contractors are solicited by submitting a tender or bid request.

Request responses from contractors for team positions

The process of acquiring contractors for the project team should be as similar to normal hiring practices as is feasible given the project's timeline. Proper due diligence and adherence to standard hiring policies and procedures can increase the chances of project success and minimize risk.



To ensure a sufficient response to an open tender/bidding process, project managers can advertise open contracts through various media or staffing organizations or communicate with previously used contractors. To widen the pool of applicants, the position could allow the work to be done remotely to allow national or international candidates to apply. Widening the pool of applicants increases selection time but may improve the quality of the selection. A response deadline is specified to ensure that staffing is completed on schedule. Contractors apply for the position by submitting an application along with a curriculum vitae/resume and references.

Request responses for procurement contracts

Requesting tenders/bids for procurement contracts is more involved than for individual team member contracts because procurement management contracts often involve large sums of money and entail significant project risk.

When requesting responses for procurement contracts, project managers ensure that responses specify when and how materials need to be ordered and professional services scheduled to account for lead time. Lead times can vary significantly, so procurement requires both diligence to determine lead times and experience to plan for situations that could lead to delays.

Other considerations related to acquiring contracted resources include:

- Conditions of the marketplace (availability or high price volatility).
- Availability of credit sources or the timing of release of funds.
- Lists of preapproved suppliers, sole-source agreements, or contractor selection criteria.

To properly prepare contracted resources to provide the best possible responses and to clarify responses, project managers may require:

- **Bidder meeting/pre-proposal conference.** Project managers can host on-site or telephone meetings with bidders to perform a walk-through of the project and answer their questions. Clarifications made in meetings can be added to bid documentation as amendments.
- **Bidder presentations.** Once proposals are received, some bidders may be asked to make a sales presentation to detail their technical and management capabilities and introduce key staff members.

Standard bidding documents

Organizations usually specify standard processes and documents for contractor selection. There may be several varieties of processes and documents to suit the type of contractor being selected, the complexity of the work, or the deliverables.



Standard bidding documents regulate the format of the request for a tender/bid from a contractor, increase comparability with other requests sent, and reduce the cost of legal review. Tender/bid documents incorporate the scope/statement of work if it exists at the time the tender/bid is sent.

Tender/bid requests must be clear enough that bidders know what the project requires, for example, construction drawings or SOWs can be interpreted only one way and require no clarification. A lagging indicator (performance data collected after the event is complete) of a good bid request is that the price range of proposals received is within 10 percent. Receiving bids in a wider range indicates that bidders made differing assumptions. In such situations the customer has difficulty in selecting the best contractor and the project itself could require numerous change orders.

The following are types of standardized bidding documents:

- **Purchase order quotes.** For some materials or products, a process of gathering quotes and availability from suppliers may be sufficient.
- **Request for information (RFI).** An RFI is a less formal request for contractors to send marketing or other information on products and services and can be used as the first step in preselecting contractors or to help when determining project requirements before detailed designs exist.
- **Invitation to tender (ITT) or request for proposal (RFP) or quotation (RFQ).** ITT, RFP and RFQ are alternate terms for detailed bid forms that announce to contractors how to make a bid and specify the project requirements at the level of detail currently available. The forms are as detailed as necessary to capture the project's scope and complexity. Requests may require the proposals to include a bid or price quote and may specify a not-to-exceed budget.
- **ITTs, RFPs, or RFQs for capital construction.** Capital construction requests are usually more complex. For construction projects, bidders submit a table of bids for each different line item in the detailed bid form (e.g., finish hardware, interior woodwork, etc.). A standardized form permits later review of bids in a table comparing each bidder against each line item. The forms also provide instructions, for example, requiring that bidders review the contract documents, visit the site and appraise local conditions such as concurrent work or weather forecasts prior to submitting a bid.



- **Technical RFP.** A technical RFP is a detailed request for designed/engineered/constructed deliverables. Technical RFPs may provide bidders with detailed designs or engineering drawings (if available) to verify that responders have the needed capabilities.
- **Subcontract requests.** Project subcontractors can be selected by the owner or the general contractor through direct negotiation or competitive bidding. If general contractors are delegated to select subcontractors, owners request complete information and references for subcontractors.

Standard proposal format

Proposals are documents prepared by the contractor that indicate their ability to satisfy relevant project objectives and produce the required deliverables within a given time frame at a quoted cost. Proposals are legally binding if agreed to in the form of a contract, but they usually contain an expiration date to account for inflation, etc.

Organizations can indicate in requests that only proposals conforming to a standardized format and received by a particular date will be considered. Standardized proposals increase comparability between multiple responses. If the organization wants to give contractors the opportunity to propose creative solutions outside of the standard format, the form can include space at the end for responders to list alternates to the base bid.

The primary part of the proposal format is a qualifications statement. For example, AIA Document 305 is a standard qualifications statement that requests the following information:

- Name of organization
- Date organization was established
- Most current set of financial statements
- Statement of qualifications
- Licensing—legal qualifications
- Related projects of comparable scope
- References

The statement of qualifications addresses the items in the bid request pertaining to the scope/statement of work and answers other questions asked in the tender/bidding document.



Select staff and contracted resources

Responders are given a reasonable deadline to submit proposals. The deadline accounts for all preparatory actions that have been requested such as site visits, documentation review, bid meetings and cost estimation.

A standardized process for reviewing and selecting staff and winning bidders is usually set by organizational policy. Standard durations for reviews, bid meetings, selection and contract award can be determined and reliably scheduled.

Select staff from available options

Project managers may select certain staff members for a project, especially team members from the FM organization. For staff that reports to line managers, project managers make their requests and then make the most of the persons the line managers provide.

Apply proposal evaluation criteria

Proposal evaluation criteria are prioritized contractor selection factors designed to maximize the probability of project success and minimize risk. Organizations may have standard proposal evaluation criteria.

Proposal evaluation criteria can be objective or subjective. Responses to objective criteria contain measurable values such as prices or experience levels. An acceptable range of values can be specified. Responses to subjective criteria require expert judgment.

To reflect evaluation criteria priorities, criteria can be weighted or ranked by importance. Price is always an important criterion and can be the primary criterion for commodities, but for more complex materials and services, best value and satisfaction of project requirements may be ranked higher.

Proposal evaluation criteria include:

- Price.
- Best value.
- Firm qualifications.
- Qualifications of project team.
- Similar project experience.
- Approach/methodology.
- Financial strength.

Legal language in tender/bid forms notes that bid selection is entirely at the discretion of the owner even if selection criteria are provided. For example, if



price is the primary criterion, tender/bid forms state that the contract will likely be awarded to the lowest responsible bidder who complies with all requirements.

Select contracted resources

Organizations apply the proposal evaluation criteria to all contractor proposals received and choose the contractor that can provide the greatest value at the lowest risk.

The process of selecting contractors may be performed by the project manager or an executive, or it could be accomplished in a meeting format. Contractor selection meetings could include the following stakeholders:

- Facility manager
- Project manager
- Upper management representative
- Owner's representative
- Relevant project team experts, estimators and analysts
- Engineering representative
- Risk and insurance representative
- Procurement department representative
- Legal department representative
- Financial and tax department representatives

Methods and tools for choosing contracted resources may include the following:

- **Line item cost and time comparisons.** If contractor proposals break costs and schedule durations down by line item, the data can be added to a spreadsheet that lists line items in rows and each contractor's estimates in columns for easier comparison.
- **Weighting.** In a weighting system, each subjective criterion is assigned a weight (e.g., 0.0 to 1.0, lowest to highest priority) and reviewers assign a numeric score to each criterion (e.g., 1 to 5, worst to best). The weight and score are multiplied to arrive at the weighted score.
- **Independent estimates.** Organizations can perform an independent cost estimate as part of project planning and use it as a benchmark.
- **Multiple screening rounds.** Multiple screening rounds eliminate proposals by setting minimum requirements or prerequisites. The first round eliminates proposals that cannot satisfy the highest priority criteria. Screening rounds can use the results of cost comparisons, weighted scores, independent estimates or other methods to eliminate proposals.



- **Expert judgment.** Legal and finance expertise is necessary when evaluating proposals. A team member with subject matter expertise is also important (e.g., a space planning professional for a space planning project).
- **Exception review.** Exception review notes variances in bidding line items that are too high or too low in comparison to other bids. The project manager asks the bidder about the exceptions to determine if there were errors. High bids can be negotiated down. Low line item bids are discussed because although the bid could be enforced, it may result in poor workmanship or change requests.
- **Contractor rating systems.** Contractors who have been used in the past can be assessed based on their ability to meet original deadlines and budgets and on the quality of their work.

Based on the combination of tools selected, the best proposal is selected and the contractor is informed.

Negotiate contracts

Contract negotiations for contracted team positions occur with staffing organizations or individual applicants. Some positions are offered with a preset payment rate or range within which to negotiate, while others may require contractors to submit bids and the bid amount could be negotiated.

For procurement contracts, organizations negotiate with bidders prior to awarding the contract on cost reductions for specific line items if the bids exceed the customer's budget or a benchmark. Cost or other scope changes are negotiated in advance whenever possible because changes may affect the schedule or deliverable quality.

Outputs

Exhibit 4-58 provides an overview of the Acquire Team and Resources outputs discussed in this topic.

Exhibit 4-58: Acquire Team and Resources Outputs in Do Phase



Staff and contractor role assignments

Staff and contractor role assignments can be specified in the following ways:

- **Team directory.** A team directory includes contact information and position descriptions for each assigned team member.
- **Team organizational chart.** Organizational charts for a project can give an overview of the team size and reporting relationships.

Documentation sent to winning bidders

Documentation sent to winning bidders includes communicating when the work should begin:

- A **letter of intent** is issued by the owner to the contractor to allow work to begin prior to execution of the formal contract.
- An **authorization to proceed** is a document issued to initiate a project and commence construction.

An authorization to proceed differs from a letter of intent in that the authorization usually requires a signed contract. Other documentation sent to winning bidders includes a congratulatory letter and a prepared contract ready to be reviewed and signed.

Signed contracts

Once contracts are signed by both the customer's and contractor's representatives, they are legally binding. Elements of a contract may include:

- Executive overview and table of contents.
- Scope/statement of work.
- Schedule with start and end dates for the contracted resource.
- Roles and responsibilities.
- Success or acceptance criteria.
- Negotiated prices, fees, retainers and payment schedules.
- Warranties and product support.
- Bonds, insurance and limitations of liability.
- Penalties and incentives.
- Subcontractor approval.
- Change order process.
- Dispute resolution and contract termination.

Kickoff meetings

Kickoff meetings are held when a project team is assembled and when professional services are acquired. A kickoff meeting allows the project manager to:

- Develop a shared understanding of the project's purpose, goals and objectives.
- Identify risks and assumptions.
- Determine preliminary resources and develop a preliminary budget for kickoffs that occur early in the design phase.



- Assign roles and tasks to team members, allow them to get clarification on tasks and get their feedback on/commitment to deadlines.
- Agree to trigger points and processes for managing noncompliance in the project related to schedule, budget or quality issues.
- Agree to variation mechanisms and controls.
- Agree to communication mechanisms and generate a schedule for additional planning team meetings.

✦ Topic 2: Execute and Control Project

During project execution, the project team follows the project management plan to produce deliverables. The project manager controls the project by checking that work is done according to plan and deliverables are produced as scheduled to meet the project's scope and objectives. The project manager corrects the course of the project or the work of individual team members as needed.

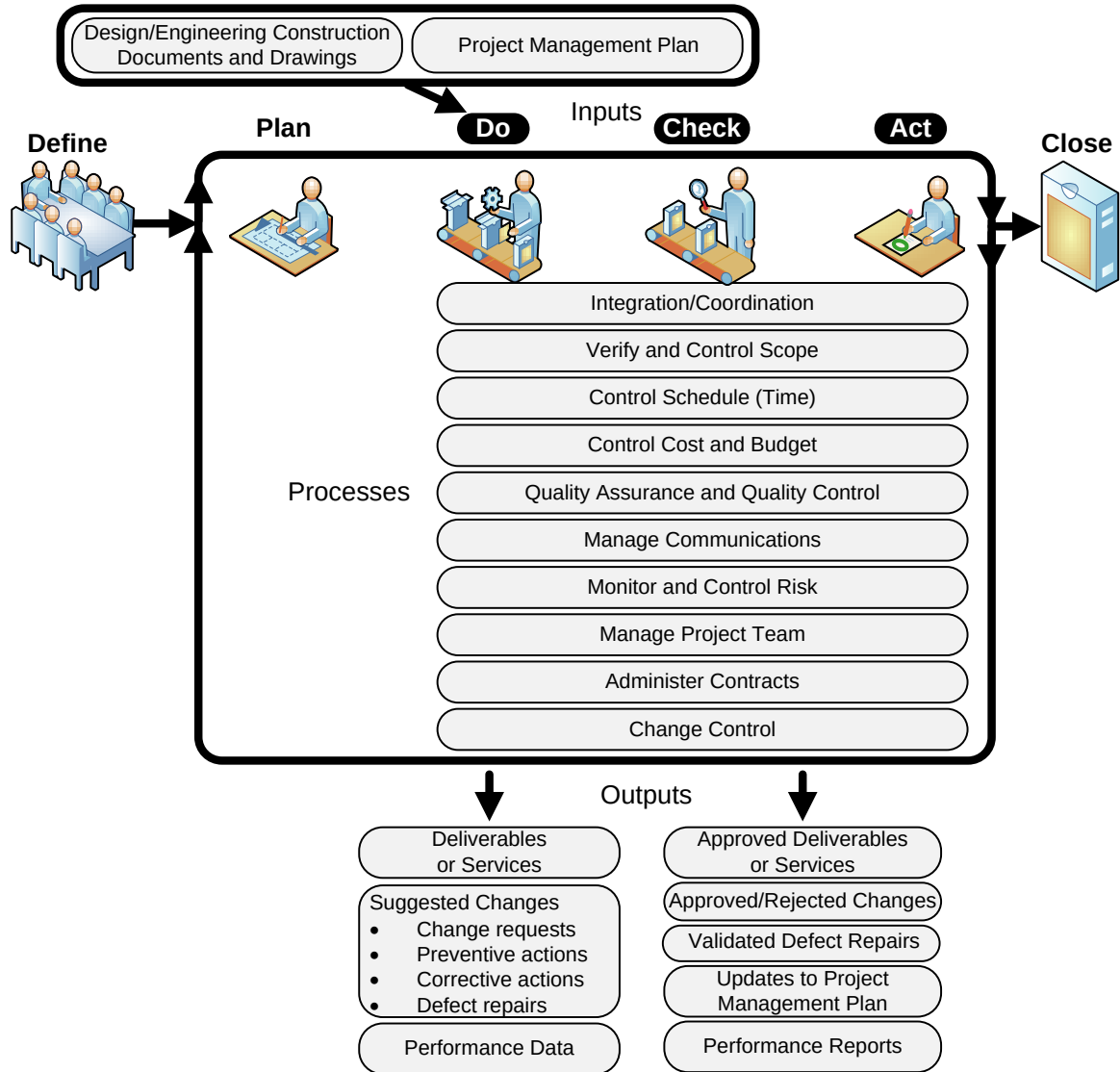
The following are excerpts from the global job task analysis that indicate some of the benefits of properly executing and controlling a project:

- Project tasks are coordinated:
 - Schedules are communicated and maintained.
 - Tasks are performed when scheduled by the people assigned.
 - Work interruptions are avoided or minimized.
 - Work is performed by people with the appropriate qualifications.
 - Rework and downtime are avoided.
- On-site inspections occur as needed.
- Project team meetings occur as needed.
- Project documents such as shop drawings are reviewed for accuracy and completeness and modified as needed.
- Work in progress and work completed are compared to project documents and specifications.
- Testing and commissioning are properly conducted.
- Steps needed to assure rights under warranty are maintained and taken.
- Performance is tracked and corrective action taken as required.
- Modifications to the plan are identified, communicated, documented and approved.
- The risk management plan is reviewed and updated.
- Project costs are tracked and controlled.
- Payments are reviewed and approved.
- A final inspection is conducted.



Exhibit 4-59 shows the inputs, processes and outputs for project execution and control, which involve the Do, Check and Act phases. These phases are discussed together because they may occur concurrently, meaning that while tasks are being done, the project manager checks the tasks and acts on the information. Checking that occurs after task completion may also trigger revisiting the task.

Exhibit 4-59: Inputs, Processes and Outputs for Executing and Controlling Projects



Inputs

Outputs from the Plan phase become inputs for the Do, Check and Act phases. As such, these inputs may include the design/engineering construction documents and drawings and the project management plan.



Process and outputs

This topic is discussed according to the key Execute and Control Project processes shown above in Exhibit 4-59. The outputs listed in the exhibit are integrated into the discussion where appropriate.

Integration/coordination

Integration or coordination during the Do, Check and Act phases is a multitasking effort for the project manager.

During project execution (Do phase), integration/coordination requires that project managers balance the project's technical needs against its organizational needs. That is, experts get the support, time and resources needed to accomplish technical goals and engineer deliverables correctly, and team members and stakeholders get the management and leadership they need to be motivated and effective. Both tasks need to be executed correctly for the project to be successful.

Integration/coordination control (Check and Act phases) involves ensuring that:

- Work is authorized and done according to the project management plan.
- Actual work is tracked and compared to planned work and variances are investigated without delay.
- The root causes of variances are investigated.
- Solutions to correcting the root causes and/or variances are considered.
- Corrective actions are approved according to the change control process.
- Project management plan elements are updated, and changes are communicated to team members performing affected tasks.

Note that the level of precision in original estimates and the overall amount of planning that was performed directly affects the level of control that can be exercised. Good planning results in good control.

Project managers check work by collecting and integrating qualitative and quantitative data on processes and results. Project managers verify that data is:

- **Valid.** Data accurately reflects actual costs and completion levels.
- **Timely.** Data is received soon enough to enable decision making.
- **Cost-effective.** Data collection does not hinder project work and the value of the information is greater than the cost spent to collect it.

Compiling data helps project managers see the big picture and develop a forecast of where the project is heading. If the projected course is likely to be unacceptable, the project manager acts to correct course using the change control process.



The project manager also integrates/coordinates documentation for use in project closure and evaluating project outcomes.

Methods and tools

Methods and tools for integration/coordination of project execution and control may include the following:

- **Earned value analysis.** Earned value analysis is a cost- and schedule-based performance measurement tool that creates a baseline cost/time for each task and measures the cost/work currently completed (earned) to estimate the likely final cost and finish date.
- **Forecasting.** Forecasting predicts future cost, time and quality of project tasks based on current trends in data.
- **Project management technology.** Organizations can leverage tools in a project management information system (PMIS) or other technology to integrate/coordinate tasks. Such systems typically include the following functionality:
 - Project planning and tracking
 - Estimating
 - Scheduling
 - Contracts and contractor management
 - Team collaboration
 - Document check-in/check-out management
 - Change orders and internal team requests for information
 - Project cost accounting
 - Calendars and other resources

Deliverables and documentation

The following are included in the deliverables and documentation of integration/coordination of project execution and control:

- **Deliverables.** Deliverable outputs include products or documentation.
- **Suggested actions/changes.** Suggested project actions/changes include:
 - Preventive actions to minimize risks found during project execution.
 - Corrective actions to bring actual work back to the plan.
 - Change orders to alter the project management plan and make it feasible given the current situation.
 - Defect repairs to fix identified defects in deliverables or processes.



- **Results of enacted changes.** Results of actions/changes are assessed, compared to intended results and validated if acceptable.
- **Performance data.** Overall project performance data is summarized.

Verify and control scope

Verifying the scope involves determining if the planned scope matches the actual scope during execution. Controlling the scope involves allowing only approved changes to the scope. The overall goal is to ensure that the project purpose and success criteria are achieved.

Verifying the scope is a deliverable and task acceptance process that occurs once work is completed on a project or a phase of the project. The project manager refers to the project management plan, including the WBS/task list, to determine whether each deliverable or service matches what was in the scope.

To conduct the deliverable and task acceptance process, project managers seek formal approval of completed deliverables and services from the acceptance authority (e.g., executive, facility manager, or board committee).

When controlling the scope, project managers apply a standardized process for all scope changes to control the impact on project duration, cost, quality and overall success. The goal of limiting scope changes is to minimize scope creep. When scope changes are recommended, the change control process (discussed at the end of this topic) is used to review and approve the changes.

Controlling the scope also includes implementing approved scope changes such as making the necessary scope changes routine rather than emergency work, updating affected project management plan elements, and communicating changes to affected workers.

Methods and tools

Methods and tools for verifying and controlling scope may include the following:

- **Design review.** Project managers review and approve design/engineering submittals, shop drawings and mock-ups.
- **Deliverable inspections.** Technical features of deliverables are tested or measured to show compliance with each relevant requirement.
- **Project management technology.** Software may include methods for updating plan and deliverable documentation after scope changes.



Documentation

The following are included in the documentation for verifying and controlling the project scope:

- **Accepted/rejected deliverables and services.** A list of deliverables that pass inspection and their sign-off documentation is retained. Deliverables that have not been accepted are listed along with the reasons for rejection.
- **Recommended actions/changes.** Required actions needed to accept rejected deliverables are listed and status is tracked.
- **Updates to the WBS/task list and other project management plan elements.** The WBS and its components are updated. Revised copies are distributed with changes highlighted. Approved changes to plan elements resulting from scope changes are made and communicated.

Control schedule (time)

Project managers check and control the schedule by assessing progress on tasks against planned progress to date and by working to minimize the causes of schedule change. If variances from the schedule are detected, either the project manager adjusts tasks to get them back on schedule or a scheduler makes approved schedule changes. Even small schedule slips are important, because schedule creep frequently occurs in small increments, such as a day here or there, that add up to a major delay.

Project managers refer to the schedule, progress reports, performance reports, contract dates and approved changes to verify the schedule and to forecast whether the project will stay on schedule. When recommending schedule changes, project managers ensure that revised schedules reflect project priorities.

Methods and tools

The following methods and tools can be used in controlling the schedule :

- **Regularly scheduled progress reports.** Project managers organize status meetings at a regular day and time to collect data on actual start and finish dates and percentage complete for work in progress.
- **Scheduling technology.** Scheduling software can show plan versus actual data, a forecasted schedule, responsibility assignments and results of prior actions.
- **Contracted resource schedule updates.** If contractors are responsible for their portion of a schedule, they are required to submit a revised schedule after change approval but before receiving their next payment.
- **Schedule variance analysis.** The magnitude of deviations from the schedule can be determined using earned value analysis and schedule



variance. Schedule variance is the amount a task is over or under scheduled time.

- **Root cause analysis.** The root causes of schedule variances are investigated because they may be positive or negative. For example, being ahead of schedule could be caused by efficient workers or by workers taking shortcuts.

Documentation

Documentation for controlling the schedule may include the following:

- **Schedule updates.** Approved schedule changes are made and communicated, with special emphasis given to critical path changes.
- **Action/change requests.** Preventive and corrective actions and changes to the schedule are inputs to change control.
- **Updates to the project management plan and lessons learned.** Approved schedule changes may require changes to the WBS, etc. Documenting root causes of schedule changes can improve future plans.

Control cost and budget

Controlling cost and the budget involves tracking costs as they occur, verifying the accuracy of cost data, identifying variances between estimated and actual costs, and influencing the root causes of variance in a budget.

Because many major budget overruns are the result of a series of small cost overruns that accumulate over time, project managers control cost by:

- Treating cost control as a daily task.
- Studying costs at the level of greatest detail (line item or work package).

In response to current or projected variances over budget, project managers are faced with difficult decisions, for example, reducing features or increasing the budget. Project managers follow the change control process for all recommended actions and changes. Furthermore, they ensure that this process includes all necessary financial controls to prevent unauthorized or incorrect expenditures (e.g., audits, separation of duties, dual payment approvals).

Methods and tools

The following methods and tools can be used for controlling cost and the budget:

- **Earned value analysis.** Earned value analysis can be used to calculate cost variance and budget variance.
 - **Cost variance** is the amount a task is over or under budget.
 - **Budget variance** is the difference between the budget at completion and the estimate at completion.



- The **budget at completion** is the planned final cost of a task/project.
- The **estimate at completion** is a forecast of final cost of a task/project using the most current data.
- **Forecasts.** Cost forecasts include the estimate at completion. Data collected at each milestone can also be used for trend analysis.
- **Variance analysis.** Project managers generate a spreadsheet with rows listing budget line items and columns listing:
 - Baseline budget amount.
 - Current budget amount.
 - Funds committed.
 - Original cost estimates.
 - Current cost estimates.
 - Amount spent this period.
 - Amount spent in prior periods.
 - Total spent.
 - Variance between budgeted and actual amounts spent.
- **Root cause analysis.** Root cause analysis of positive and negative cost variances can highlight how much each of the following is a factor:
 - The item price or rate for work differs from the estimate.
 - The quantity of items or amount of work differs from the estimate.
- **Cost control technology.** Cost tracking software can ensure that no item is neglected and that change control is used.
- **Review meetings.** Analysis and forecasts can be reviewed in regular meetings to communicate issues and the status of remedies.

Documentation

Documentation for controlling costs may include the following:

- **Updated cost estimates/budget.** Original and revised estimates are tracked. The budget is updated only when required by scope changes or when budget variances are determined to be too large to be corrected.
- **Suggested actions and changes.** Recommendations are tracked.
- **Updates to project management plan and lessons learned.** Changes to cost estimates or budgets may affect the WBS, quality management, etc. Variances and root causes are recorded for use in evaluating outcomes.



Quality assurance and quality control

Quality assurance and quality control are organized methods of determining whether processes and deliverables meet specified quality goals. They are tasks that cut across all other plan elements and involve all team members.

Quality assurance (QA) is a process-oriented set of tools and techniques to monitor and control a project's processes with a goal of ensuring that the project will meet its objectives. QA verifies that the right tasks are being done and implements process improvements based on the results of quality control measurement and analysis. QA activities include:

- Verifying that an effective plan and process is in place from the start to minimize later issues.
- Monitoring processes to apply prevention.
- Performing quality audits.
- Creating and using process checklists.
- Requiring process changes as necessary.

Quality control (QC) is a product-oriented set of measurement and analysis tools used to monitor project results and deliverables. QC determines if results and deliverables comply with quality standards and seeks to discover the root causes of quality issues. QC is an ongoing task throughout a project that involves:

- Testing and inspecting intermediate and final deliverables.
- Analyzing project results such as schedule and budget performance.
- Requiring defect repairs as necessary.

One way to understand the difference between quality assurance and quality control is that quality assurance emphasizes prevention while quality control emphasizes inspection. Prevention is the detection and removal of process flaws during execution; inspection is the detection and removal of flaws in deliverables at key milestones or at completion. Resolving defects through prevention is more cost-effective than through inspection. However, inspection is usually necessary on a project; prevention is used in part to reduce the costs of inspection.

Sources of quality control testing and inspection measurements include the acceptance tests from specifications/SOWs in work packages and contracts as well as measurements specified in quality standards, metrics and checklists listed in the project management plan.

When preparing to perform quality assurance or quality control, the project manager, QA or QC person or team member may review approved quality metrics and checklists, the quality management plan, feedback from prior quality processes, approved actions and changes, and/or defect repairs.



Methods and tools

Methods and tools for quality assurance and quality control include use of international quality standards. For example, ISO 9001, “Quality Management Systems,” is a broad family of quality standards that can be applied to quality assurance and quality control. It includes procedures for monitoring processes for effectiveness, record keeping, continual improvement, testing and inspection of deliverables for defects, taking corrective action, and analysis of the quality system itself.

Quality audits are used for quality assurance. They are independent reviews conducted at scheduled or random intervals by a trained internal or external auditor. Quality audits determine policy, procedure or process compliance, such as determining whether the change control process is being followed.

Methods and tools for quality control may include the following:

- **Testing and inspection.** Testing and inspection are measurements performed on deliverables to detect and remove errors before deliverables are forwarded to the next project process or final deliverables are approved and handed over to project sponsors/owners.
- **Building, life safety, health, fire inspections.** Inspections for facility compliance with relevant codes are a key quality control task for projects involving design and construction activities.
- **Defect repair validation.** After reported deliverable defects have been repaired, the deliverable is tested by a quality control inspector. Original tests are repeated, and a certain number of experiments may be required such as attempts to get the defect to reappear.
- **Root cause analysis.** Root cause analysis applies a number of quality tools to seek the basic underlying cause of defects or variances.

Documentation

The following may be included in documentation for quality assurance and quality control:

- **Suggested actions, changes or defect repairs.** Detected quality issues are forwarded to the change control process.
- **Validation of deliverables or repaired defects.** Validation reports are retained for project/contract closure and as a potential legal defense.
- **Updates to the project management plan and lessons learned.** Testing may reveal weaknesses that can be corrected in the quality plans. Changes to other areas could include schedule changes for additional testing. Completed checklists and test results are retained for lessons learned, and emphasis is placed on root causes and the effectiveness of actions.



Manage communications

Managing communications consumes a great deal of the project manager's time, but it is the glue that holds the team together and gives other stakeholders a sense of participation. It also gives stakeholders a chance to give the project manager valuable feedback. During the Do, Check and Act phases, managing communications involves reporting performance and managing stakeholders.

Reporting performance

Reporting performance involves collecting performance data from team members responsible for each of the plan elements, analyzing the data, arranging the information to suit the purpose and audience, and presenting the relevant reports to stakeholders.

Performance reports measure progress relative to the project management plan and primarily focus on scope, schedule, budget and quality. Performance reports include the following:

- Status reports differentiated by their purpose:
 - Current period reports that track detailed progress on tasks since the last meeting
 - Cumulative reports that present trends and forecasts
 - Exception or variance reports that provide timely and succinct information for corrective action
- Aggregated or detailed team and contractor performance reports
- Senior management reports that summarize status at a high level along with proposed plans for problem resolutions
- Financial reports that summarize financing, budgets or cost controls

Reports are control tools. Increasing the frequency of reports increases the number of control points and reduces project risk. Report frequency is balanced against the cost of reports in terms of time needed by team members to prepare and explain/present the reports. Therefore, some reports are regularly scheduled while others are prepared only as requested.

Methods and tools

The following methods and tools can be used for reporting performance:

- **Data analysis and reporting technology.** Technology can reduce the time required for workers to gather and report data on their activities. Online project management tools can allow remote team members to share information and hold virtual meetings.



- **Presentation skills.** Presentation skills include setting priorities such as beginning and ending meetings with the key information that needs to be absorbed. If reports are specialized, such as financial reports, the expert representative for that specialized area presents that report.
- **Status meetings.** Status meetings include information on project changes, the status of issues from the prior meeting, and new issues. If weekly status meetings are held for project teams, they are ideally on the same day each week. Status meetings are usually held less frequently for other stakeholders (e.g., by milestone).

Documentation

Documentation for reporting performance may include meeting minutes, which are reports summarizing meetings that are distributed to attendees and team members who have a representative at the meeting.

Managing stakeholders

Managing stakeholders is a task for the project manager that involves regular and ad hoc communications with project stakeholders to resolve issues and ensure that they feel informed and supported. Stakeholders include project sponsors and decision makers (senior executives or clients), local government officials/inspectors, the project team and professional services, material suppliers, affected end users, user representatives such as unions, and the local community affected by the project. Project managers need to communicate with stakeholders both formally and informally to ensure that their concerns are being addressed. They may need to use a variety of leadership and management skills such as conflict resolution between two or more stakeholders or stakeholder groups.

Stakeholder management is a form of team building. Stakeholders who feel involved are more likely to have project buy-in. Involved stakeholders are less likely to disrupt the project, are more likely to accept the final product or service and are in a better position to understand changes or problems as they arise.

When preparing to manage stakeholders, project managers review the communications management plan to ensure that no stakeholders are omitted and that the appropriate content and communication styles/media are used.



Methods and tools

Methods and tools for managing stakeholders may include the following:

- **Leadership and influence.** Leadership and influence guide stakeholders to support the project's purpose and avoid being counterproductive.
- **Stakeholder team building.** To develop a sense of teamwork for stakeholders outside of the project team, the project manager conducts in-person meetings such as kickoff meetings, milestone reviews and deliverable acceptance meetings.
- **Communications.** Project managers review their intended communications and media to ensure that the message is at the appropriate level of formality and is clear and concise. They summarize stakeholder replies to confirm that both parties understand each other.
- **Issue logs.** Issue logs can be generated for stakeholders in the same manner as for teams. They assign an owner and a target date for resolution. They help stakeholders see that their issues are being taken seriously and allow stakeholders to track progress on resolutions.

Documentation

The following may be included in documentation for managing stakeholders:

- **Stakeholder reports.** Project managers send stakeholders reports on project status and resolution of issues they raised or changes they suggested.
- **Updates to issue logs.** Issues may be resolved or new issues added.
- **Updates to the project management plan and lessons learned.** Approved changes to communications management require plan updates. Successful or failed methods are tracked as lessons learned.

Monitor and control risk

Monitoring and controlling risk involves determining the status of identified risks, implementing planned risk responses, determining the impact of responses and tracking residual risk, identifying and prioritizing unanticipated risks, and resolving claims and disputes.

Risk management activities during the Do, Check and Act phases involve monitoring risk and controlling risk.

Monitor risk

Monitoring risk involves watching for leading indicators and red flags of known risks and identifying new risks or risks that are increasing or decreasing in likelihood. It is a process that occurs continuously throughout the project after the risk management plans are in place.



The risk owner (i.e., the team member assigned responsibility for a given set of risks) reviews the risk management plan, risk register, approved changes and performance reports to determine whether risks have changed in their likelihood or severity, whether risk policies and procedures are being practiced, whether project assumptions or constraints have changed, and whether contingency reserves of funds or schedule time will be adequate to respond to new or escalating risks.

Methods and tools

Methods and tools for monitoring risk may include the following:

- **Risk assessment updates.** A midproject risk identification meeting or other risk identification process may be held to brainstorm new risks.
- **Earned value and variance analysis.** Variances from the project management plan indicate whether risks are increasing or decreasing in likelihood or severity. Risk owners treat the earliest point at which a variance begins to appear as a critical period. A response may be ineffective once a variance has grown.
- **Technical performance analysis.** Risk owners evaluate technical project achievements at a high level, combining analyses of time, cost and quality to determine if the scope and purpose are likely to be achieved.
- **Contingency funds review.** Risk owners monitor the risk budget and forecast adequacy of remaining funds.

Documentation

Documentation for monitoring risk may include risk reports. Risk reports are provided to customers or executives to summarize the risks for the current period and propose responses.

Control risk

Controlling risk involves:

- Implementing planned risk responses.
- Devising and implementing responses to unanticipated risks.
- Assessing the effectiveness of risk responses both during their execution to make corrections as feasible and after their completion to update “lessons learned” documents.

Methods and tools

The following methods and tools can be used in controlling risk:

- **Management.** Project managers monitor the decisions of risk owners and ensure that they conform to the project’s risk tolerance levels.
- **Status meetings.** Risk events and risk responses can be items for discussion and deadline/responsibility assignment in status meetings.



Documentation

Documentation for controlling risk may include the following:

- **Approved actions.** The recommendations from new risk identification tasks, if approved, may require urgent preventive or corrective action.
- **Updates to the project management plan.** Approved changes may require plan element changes. The risk register is a key element to update; in addition to updating or adding items, risks that no longer apply are closed and risk events and responses are recorded.
- **Updates to lessons learned.** Risk owners evaluate the impact of risk events that occurred along with the effectiveness of responses.

Manage project team

Many facility management projects will have small project teams consisting of professional staff or contractors with extensive project experience. The project manager's role in these situations is more as a problem solver than as a controller. Project managers assign work packages and clearly explain expected results and thereafter allow the team to function effectively without interference other than results monitoring.

When teams consist of many new hires or previously unused contractors, the project manager may need to engage in management and team-building activities to get the team working in the same direction.

Project team management may involve:

- Observing team and individual behavior.
- Verifying completion of tasks or deliverables.
- Providing appropriate encouragement and feedback.
- Resolving conflicts or performance problems promptly.
- Making project team changes to maintain or optimize performance.
- Conducting periodic performance assessments/reviews.
- Redirecting work in response to current performance output.
- Integrating/coordinating the work of contractors.
- Providing training as necessary and feasible.

Methods and tools

Methods and tools for managing a project team may include the following:

- **Management and leadership.** Project managers monitor progress and influence staff and contractors to correct their own course as needed. The project manager enforces strict adherence to contract SOWs.
- **Partnering mindset.** Project managers treat staff and contractors as partners who share a common commitment to success. They apply a



win-win philosophy and continually evaluate and reaffirm mutual objectives.

- **Rewards and recognition or penalties.** To reinforce desired behavior, project managers use rewards, such as a monetary bonus (if specified), and recognition, such as praise, constructively:
 - Individual recognition can be announced to the team, but individual rewards are kept private to avoid a negative effect.
 - Team rewards are preferred to individual rewards because they foster cohesiveness.
 - Rewards and recognition are always linked to elements under the control of the person or team receiving the reward/recognition.

Penalties include formal documentation of issues or removal from the project. Monetary penalties can also be used. Note that application of contractual rewards/penalties is an administration task (discussed next).

- **Conflict resolution.** Project managers prevent conflicts by proactively defining roles, communicating frequently and setting the tone for expected behavior. Project managers develop an informal conflict resolution process that stresses timely response and follow a formal conflict resolution process for issues that cannot be informally resolved.

Administer contracts

Project managers administer contracts for all manner of contracted resources, including contracted team members, supplied materials and contracted professional services. For the project manager, this is a partnering process. The project manager communicates to contracted resources that beyond the contract itself is an implied covenant of good faith, meaning that both parties need to commit to open communications and build trust if the relationship is to succeed. Succeeding at these elements allows potential problems to be resolved informally before needing to resort to agreed-upon conflict resolution procedures.

Contract administration for a designated contract administrator consists of the following tasks:

- Paying contractors and accounting for payments
- Changing contracts as the result of contract renegotiations and subsequent change orders
- Monitoring service level
- Implementing formal conflict resolutions
- Administering contractual rewards or penalties
- Contract closure or early termination (addressed in Topic 2 of Chapter 5)



The following are excerpts from the global job task analysis that indicate some of the benefits of properly administering contracts:

- Any special requirements are verified.
- Contractors are oriented as to the purpose of the project, the criteria used to judge their performance, and the project plan.
- Contractors are given periodic feedback.
- The appropriate level of oversight is maintained.
- On-site inspections occur as needed.
- Project team meetings occur as needed.
- Timely corrective action is taken when work does not meet specifications, tasks are not done according to plan or timelines are not met.
- Project status is reported according to plan.

As there are two sides to any contract, contract administration is a task shared by both the designated contract administrator and the contracted resource. When administering contracts, the contract administrator consults with the legal department to understand the legal implications of administrative actions performed on a contract.

The contract administrator prepares to administer a contract by reviewing the SOW and contract details, the project management plan, any data from prior projects using the contractor, and approved contract changes.

Methods and tools

The following methods and tools may be used in contract administration:

- **Administering contract change orders or renegotiations.** Contract administrators make required changes to contracts after the changes have been cleared by the legal department and both parties sign off on the changes. Changes can be constructive or disputed:
 - **Constructive changes** are changes that at least one party feels are needed. If both parties agree the change is constructive, the contract administrator changes the contract.
 - **Disputed changes (claims)** arise when at least one party feels that a change is not constructive or necessary. Problems can arise in the pricing of changes or if the contractor feels that additional work requested is outside the contract but the buyer disagrees. The parties meet to informally resolve the problem or resort to arbitration or litigation as stipulated in the contract.



- **Accounts payable.** Payments to contractors are approved and documented in compliance with contractual payment terms. Payments linked to progress are released after documentation verifies the work.

Documentation

Documentation for administering contracts may include the following:

- **Progress reports.** Contractors make regular reports on their progress.
- **Project variance reports.** Variances between promised and actual deliverables, costs and deadlines are recorded.
- **Documented changes to contracts.** Approvals for changes are documented, and contract changes are communicated to affected parties.
- **Statutory communications.** Contract administrators issue contractually required communications, for example, a notice of failure to perform.
- **Requests for payment.** Contractor requests for payment are processed.
- **Payments.** Payment records include dates and amounts of payments made and a schedule of pending payments.
- **Tax forms.** Year-end tax forms are sent to contractors and the government as required.
- **Project management plan and “lessons learned” updates.** Contract changes may require updates to the project management plan or archives.

Change control

Change control, also called the change order process or variations control, is a standardized method for regulating project changes to ensure that:

- The impact of proposed changes is understood.
- Changes are reviewed and approved/rejected.
- Only approved changes are enacted.
- The project objectives statement, project management plan and final deliverable documentation are updated.
- Persons responsible for performing relevant tasks are informed of changes.
- Changes are verified.

Recommended changes are channeled through reviewers and approved by one source alone, and the approval process is clearly communicated to all parties. The review/approval source could be the project manager, the facility manager, an executive or a change control board. Other stakeholders such as the customer, design firm or general contractor are usually designated to consult with the approver. The danger of having customers be change decision makers is that unlike facility managers or project managers, they may not have the expertise or perspective to foresee how a change affects the scope.



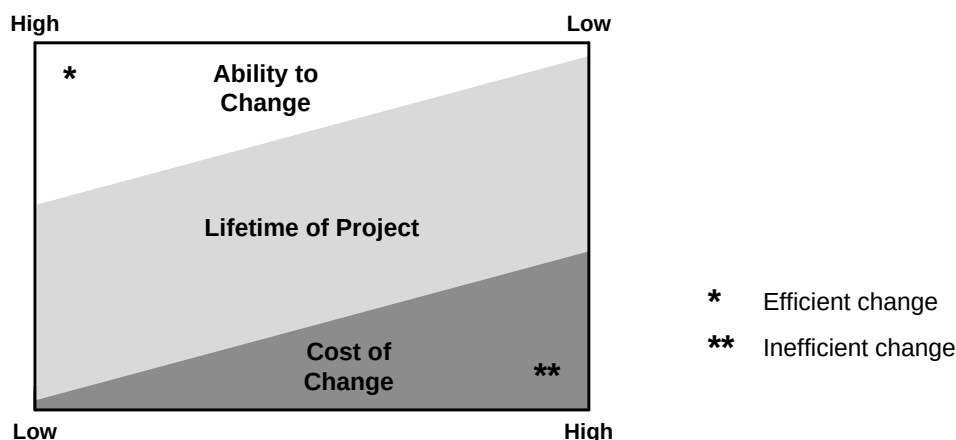
The change control process includes a standardized way to communicate changes to affected parties so that the changes can be understood and incorporated into routine work (as opposed to continually making changes in an emergency atmosphere).

Change control is an element of the project management plan that is implemented throughout the project. Changes during the Define and Plan phases are normal parts of progressive plan elaboration, but project managers minimize changes in later phases. Midproject change is minimized by approving only changes that increase alignment with the project's purpose and success criteria. Types of midproject change include the following:

- **Change orders/requests for change (RFCs).** Change orders are for changes that affect the project scope (e.g., add features) and revise the project management plan. Typical reasons for scope changes include owner revisions, alternative materials, unforeseen field conditions, document errors or omissions, regulatory changes and system clashes/conflicts.
- **Configuration or version change.** A proposal may be made to alter configurable options or upgrade to a new version of a software package.
- **Preventive actions.** Preventive actions are risk responses that are recommended to mitigate perceived project risks that were not initially discovered in risk management.
- **Corrective actions.** Corrective actions are suggested course corrections to return the project to the path defined in the project management plan.
- **Defect repairs.** Quality management may discover defects in materials, processes or deliverables. Completed defect repairs are validated.

The rationale for limiting midproject changes is that over time the ability to make a change efficiently and effectively decreases while the cost of the change increases, as shown in Exhibit 4-60.

Exhibit 4-60: Lifetime Cost versus Cost of Change/Ability to Influence



Project managers decide the best point in a project to implement approved actions/changes and use integration/coordination skills to ensure that all affected plan elements are updated. For actions/changes that are truly emergencies, project managers may create an emergency path to bypass the standard change proposal and approval process. The project manager may need to audit the emergency process to ensure that the system is being used properly.

Methods and tools

The following methods and tools can be used in the change order process/variations control:

- **Expert judgment.** Project managers apply expert judgment based on project priorities, experience from prior projects and formal training when designing a change process and evaluating the impact of changes.
- **Approval/rejection process.** Project managers ensure that suggestions are neither forgotten nor implemented without consideration and approval.
- **Changes to published plans/work.** Project managers ensure that approved actions/changes are translated into plan changes through plan republication or addenda, and changes are implemented in schedules or work in process.
- **Requests for information.** RFIs in a change control context are requests from staff/contractors for clarification/interpretation of SOWs.
- **Change orders/requests for change (RFCs).** Staff/contractors can issue change orders/RFCs to recommend a change to plans or SOWs.
- **Formal contractual and pricing variations.** Clauses may exist in approved contracts and SOWs that specify conditions that would trigger a formal contractual or pricing variation.
- **Meeting minutes.** Change control decisions are often made in meetings, and the meeting minutes are retained to show how decisions were made.
- **Change control technology.** Project management software may contain automated change control tools.

Documentation

Documentation for the change order process/variations control may include the following:

- **Approvals.** The approval process and specific roles are communicated to all parties. Approved actions/changes are documented with the appropriate signatures including approval and receipt of approved changes by team members responsible for their implementation.
- **Deferrals or rejections.** Rejected actions/changes and the reason given for their rejection are tracked to ensure that they are not being



implemented, for lessons learned, or for possible implementation in a follow-up project.

- **Validated/rejected defect repairs.** The acceptance or rejection of defect repairs is recorded for project acceptance and legal defense purposes.
- **Updates to the project management plan and lessons learned.** Changes to plan elements and the relative success of change control are recorded.



Progress Check Questions

Directions: Read each question and respond in the space provided. Answers and page references follow the questions.

1. Which of the following is true of acquiring staff or contractors for a project?
☐ a. Staff/contractor specifications are always finalized before acquiring the staff/contractors.
☐ b. Lead time refers to the ability of a candidate for a position or contract to be ready to start when needed.
☐ c. If a project manager needs a staff member from a different department, the department head may have the final say in the assignment.
☐ d. Availability is the delay between when materials or services are requested and when they are on hand at the right time and place.
2. Which of the following is a method of acquiring contracted resources for a project that tends to find the best available market price so that the project goals can be achieved at the lowest cost?
☐ a. Direct negotiation
☐ b. Open tender or open bidding
☐ c. Hiring
☐ d. Preselecting contracted resources
3. Requiring proposals to include high bid, performance or payment bonds is a form of
☐ a. indemnification.
☐ b. preselecting.
☐ c. direct negotiation.
☐ d. prequalifying.
4. Which of the following is a way to explain a tender/bid to improve the quality of proposals received?
☐ a. Bidder meetings
☐ b. Selection criteria
☐ c. Bidder presentations
☐ d. Requests for information
5. Which of the following is a standard component of AIA Document 305 that pertains to the SOW?
☐ a. RFP addenda
☐ b. Statement of qualifications
☐ c. Selection process
☐ d. Letter of intent



6. Which of the following is a tool the project manager can use to determine if the project is likely to stay on budget and on schedule?
- ☐ a. Change order submissions
 - ☐ b. Root cause analysis
 - ☐ c. Interface development
 - ☐ d. Earned value analysis
7. Which of the following is a process-oriented set of tools and techniques?
- ☐ a. Quality assurance
 - ☐ b. Quality control
8. Which of the following is the most cost-effective method of resolving defects in deliverables?
- ☐ a. Inspection
 - ☐ b. Transfer
 - ☐ c. Prevention
 - ☐ d. Mitigation
9. When a project has a designated contract administrator, which of the following is a task that the project manager would perform?
- ☐ a. Partnering process
 - ☐ b. Changing contracts as a result of a change order
 - ☐ c. Implementing formal conflict resolutions
 - ☐ d. Monitoring service level
10. An owner suggests that an alternative material be used in a project. This action would involve a
- ☐ a. change order.
 - ☐ b. corrective action.
 - ☐ c. preventive action.
 - ☐ d. defect repair.



Progress check answers

1. c (p. 4-235)
2. b (p. 4-237)
3. d (p. 4-238)
4. a (p. 4-239)
5. b (p. 4-241)
6. d (p. 4-249)
7. a (p. 4-254)
8. c (p. 4-254)
9. a (p. 4-261)
10. a (p. 4-263)



Chapter 5: Close Projects

After completing this chapter, students will be able to:

- Verify that all tasks have been completed and deliverables installed at the end of a project.
 - Understand how to conduct final deliverable reviews, such as checklist reviews or punch-list/snagging-list walk-throughs.
 - List the steps in the final inspection or validation process, including defect repair and validation and deliverable acceptance.
 - Understand the use of certificates of occupancy, commissioning, and occupying space for a design and construction project.
 - Describe the contract closure process, including conducting management tasks that use judgment and administrative tasks that require diligence.
 - Understand how to close projects, including issuing formal acceptance documentation, generating closure documents and dismissing teams.
 - Ensure that an organization learns from its successes and failures by collecting, evaluating and presenting data on project outcomes.
-

✦ Topic 1: Accept Deliverables or Occupy Space

Accepting deliverables or occupying space is an integration/coordination task for project managers that involves:

- Integrating/coordinating completion of all scheduled tasks.
- Verifying that all deliverables have been installed (if applicable).
- Testing project deliverables against acceptance criteria.
- Accepting or rejecting deliverables.
- Receiving validation of repaired or corrected deliverables from quality control.
- Transferring the deliverables to owners or responsible parties such as the facility management organization.
- Relocating staff and equipment into new or renovated space.

Accepting deliverables or occupying space involves formal review and acceptance of deliverables based on acceptance criteria, which are the portion of the project's success criteria and user requirements relating specifically to the features and quality expected in final deliverables.

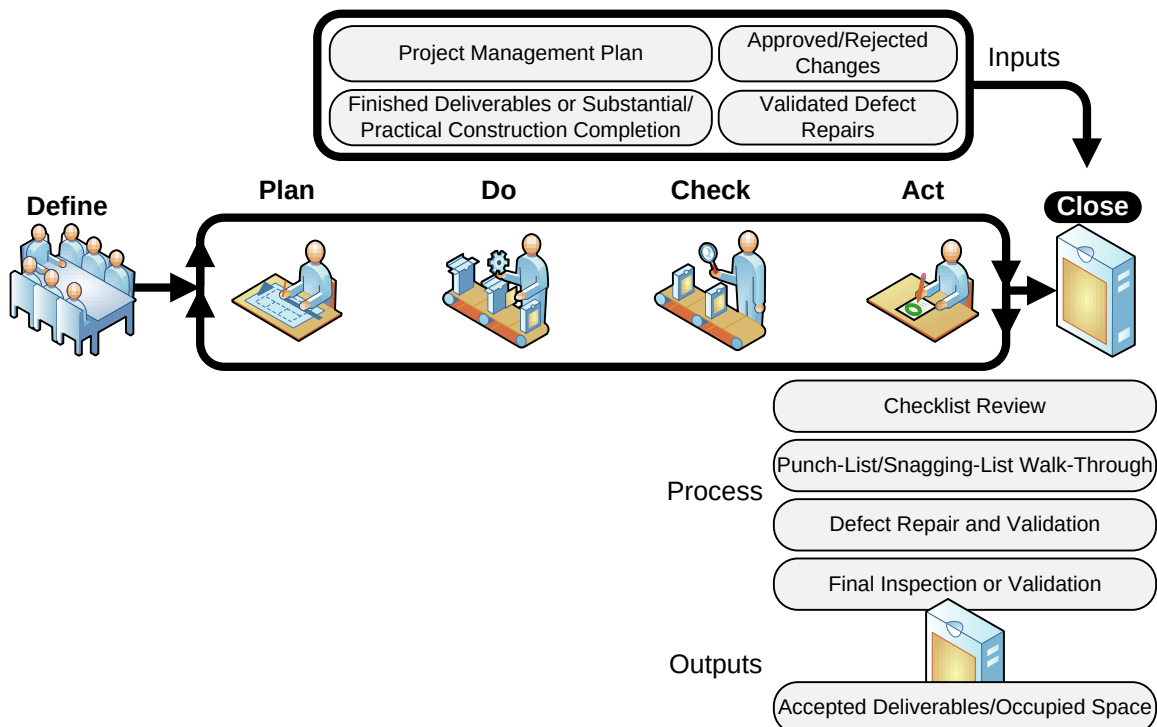


Once formal acceptance takes place, the deliverables become the owner's responsibility. The owner is the executive/client who takes custody of the deliverable. Typically the owner and the project sponsor are the same person. For FM projects, the owner typically puts the facility manager in charge of operating and maintaining the deliverable. In other words, the asset or service program becomes the object of regular FM activities.

The owner determines when the project is done. If the project deliverables or services are not acceptable, then acceptance of deliverables or occupation of space may be delayed until correction and validation processes occur. Correction and validation processes continue to occur until either the involved parties are satisfied or the project is cancelled. An exception to this is when the deliverables are events (e.g., conferences or conventions). Once the event occurs, the project ends whether or not the owner was satisfied.

Exhibit 4-61 shows the inputs, processes and outputs for accepting deliverables or occupying space.

Exhibit 4-61: Inputs, Processes and Outputs for Accepting Deliverables or Occupying Space



Inputs

Outputs from prior activities become inputs for determining whether or not to accept deliverables or occupy space. As such, these inputs may include the

project management plan, approved/rejected changes, validated defect repairs, and finished deliverables or substantial/practical completion.

Project schedules include a checkpoint or milestone showing a deliverable's anticipated finish date/substantial completion. Unanticipated successes/challenges could cause this date to vary, so project managers base these decisions on:

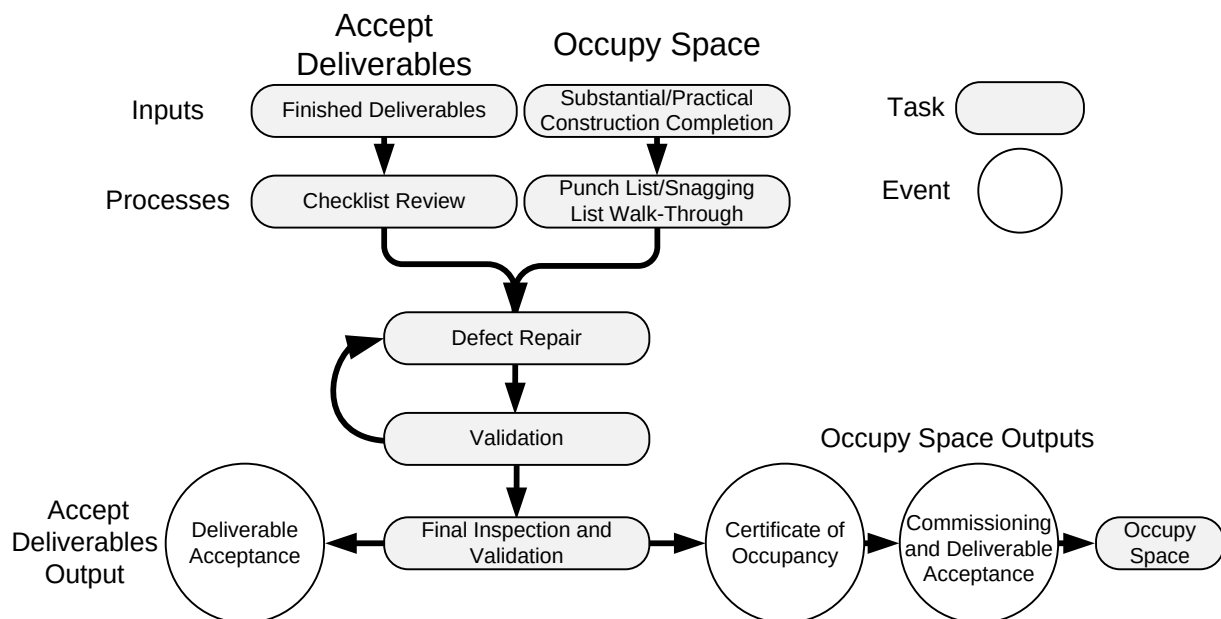
- Completion reports from persons responsible for doing the work.
- Completed process checklists from quality assurance.
- Testing and inspection and defect repair validation reports from quality control.

If all tasks/processes are reported complete and all known defects have been validated, the deliverable is ready for final review. For design and construction projects, the project manager also informally reviews the site to ensure that the work appears complete, the site is clean and contractor tools are removed. The project manager should not see incomplete work with the possible exception of areas prepared for owner-furnished items (e.g., security system).

Processes and outputs

Exhibit 4-62 provides a process-oriented view of the inputs, processes and outputs for accepting deliverables or occupying space discussed in this topic. Note that the processes and outputs for receiving deliverables or occupying space are similar but have differences in some tasks/events.

Exhibit 4-62: Process-Oriented View of Accepting Deliverables or Occupying Space



The following processes and outputs are discussed in this topic:

- Checklist review
- Punch-list/snagging-list walk-through
- Defect repair and validation
- Final inspection and validation
- Certificate of occupancy
- Commissioning
- Deliverable acceptance
- Occupying space

Checklist review

Checklists for final deliverables are a quality control tool developed to review a final deliverable from an entire system perspective. Prior to this point, the focus of testing, inspection, repair and validation is typically related to project components such as work packages and tasks. A systemwide checklist ensures that the deliverable(s) function as a complete system, that nothing is missing, and that they satisfy project objectives and project success criteria/acceptance criteria.

Punch-list/ snagging-list walk-through

A punch-list or snagging-list walk-through is a detailed on-site review of a substantially completed construction site with the general project manager, construction project manager, facility manager, owner and consultants.

Contractors may be responsible only for rework listed on the punch list, so the walk-through review is thorough. Every door, water tap or other element is tested. Project managers avoid creating an adversarial relationship with contractors by showing some flexibility for minor flaws. In return, many contractors will repair some flaws found after the walk-through.

The output of a punch-list/snagging-list walk-through is an itemized punch list/snagging list, which are items requiring defect repair and validation.

Defect repair and validation

A list of rejected deliverables is provided in writing to the responsible project team members/professional services, with reference to the unmet criteria in the specifications/SOWs and the required corrective actions or defect repairs. Items listed for repair on punch lists are the responsibility of the construction project manager.

Once the project team member/professional service completes the repairs, the deliverables are validated by quality control. Unless contracts are terminated, contracts remain open until all deliverables have been accepted and repairs have been validated.



Final inspection and validation

A final inspection and validation or deliverable acceptance review verifies that all requirements have been satisfied and all deliverables are in place as measured by deliverable acceptance criteria. Acceptance criteria are metrics specified in the project management plan and contracts for each feature of the deliverables and the deliverable as a whole. The metrics are traceable back to the project's statement of objectives (including success criteria), statement of requirements and approved change orders.

Design and construction projects usually require city or local officials to conduct a final inspection for building code compliance. If the review reveals any deficiencies, it is the owner's responsibility to make the required changes because the facility cannot be occupied until it passes this inspection.

Certificate of occupancy

City or local officials issue a certificate of occupancy or certificate of satisfactory completion once a facility has passed its final inspection and is determined to be in compliance with all building, life safety, health and fire codes. No occupancy or use is allowed until this certificate is granted, so obtaining this certificate is usually on a project's critical path. Note that some government units may provide a temporary occupancy permit to allow relocation or other activities to commence while final corrections are under way.

Commissioning

Commissioning, or building commissioning, is a systematic process to ensure that building performance is in harmony with the intent of its design and the operational needs of its owner. If commissioning is used, it is integrated into every part of a project, from its definition and planning to its execution and control. The project will have a commissioning authority, who is a team member that reports directly to the building owner and directs all quality assurance and quality control activities.

The commissioning authority is responsible for commissioning a facility once the facility meets all commissioning requirements for functionality, maintainability and sustainability. He or she continues to monitor the facility during the warranty period and possibly for an extended operations and maintenance period.

Deliverable acceptance

Deliverable acceptance is a written formal notice to the project manager and contractors signed by the project manager and by owners or executives indicating that the owners are satisfied that all project deliverables meet user requirements and acceptance criteria and acknowledging receipt of the deliverables by the responsible party.

When transferring deliverables to operations and maintenance or other parties, deliverable acceptance may include a "go live" date, phased implementation,



or a period of redundant operation if the deliverables are replacing a system (e.g., new building/old building, software) that is being retired but end users require continuous access. When a project has multiple phases or deliverables, deliverable acceptance may occur in phases.

Deliverable acceptance may trigger warranty, maintenance or limit of retention/retainage periods.

Warranty period

When deliverables are officially accepted, contractually obligated warranty periods may begin. Warranties are guarantees of quality workmanship and deliverable quality that can obligate a manufacturer or construction contractor to repair or replace defects at their own expense if the defect is reported during the warranty period. Relevant warranty types may include contractor, manufacturer, workmanship and product warranties.

Warranty information is forwarded to facility managers along with the related expiration dates, terms and conditions, or ongoing costs.

Maintenance period

Maintenance periods typically begin at deliverable acceptance. Maintenance or extended service agreements provide routine maintenance of deliverables over a promised period to ensure that they are properly maintained during their critical early life stages.

Limit of retention or retainage

Projects that involve a general contractor and subcontractors will have a retainage period that begins at deliverable acceptance. The retainage period ends when all subcontractors are paid or the limit of retention is reached, at which point the general contractor is issued a final payment. The purpose of retainage is to ensure that no liens remain on project work at project closure.

Occupying space

Occupying space typically involves a major relocation of staff, furniture and equipment. Relocation projects can be complex and require devoting sufficient time for project definition and planning to be successful. The ongoing case study in this course addresses this and many other considerations of a relocation project.

Topic 2: Close Contracts and Project and Evaluate Outcomes

When closing contracts and the project and evaluating outcomes, organizations close remaining contracts, record performance metrics, compare



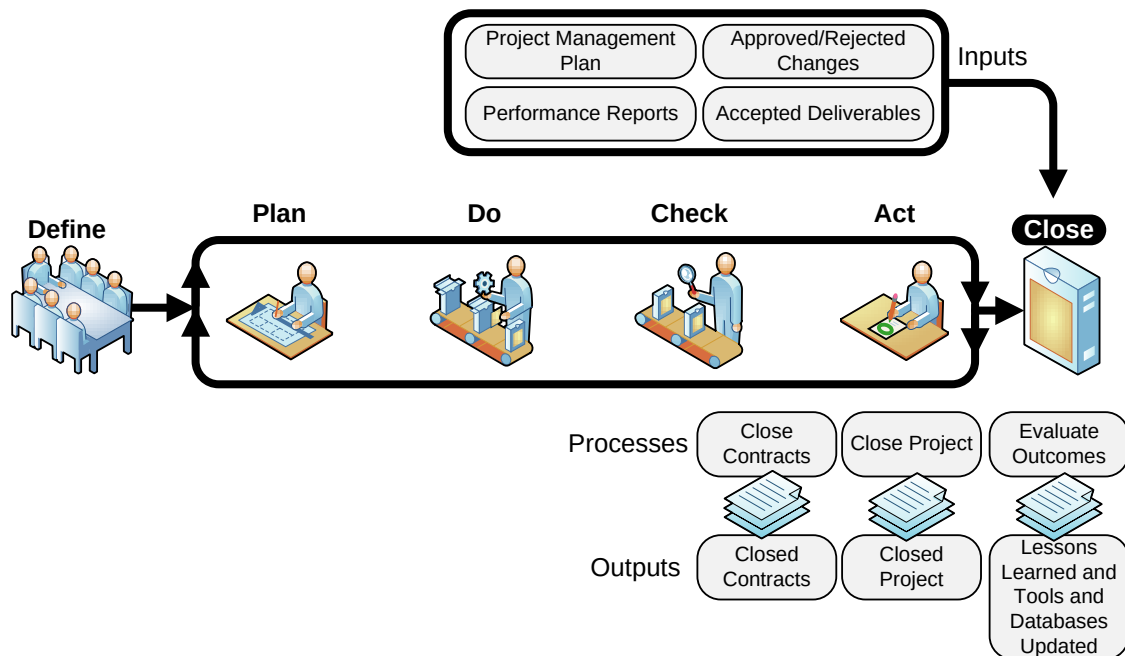
and document outcomes versus goals, and assess customer satisfaction. Based on the data they collect, organizations identify and document lessons learned or opportunities for future improvement and communicate outcomes in meetings and printed and online media.

The following are excerpts from the global job task analysis that indicate some of the benefits of properly performing all closing activities:

- The process used to manage/oversee the project is reviewed to identify future opportunities for improvement.
- Project outcomes are compared to the project goals and objectives.
- Project outcomes are documented and communicated.
- Opportunities to improve future projects are documented and communicated.
- Lessons learned are documented and communicated.
- Performance metrics associated with the process are captured and documented.
- Customer satisfaction is solicited and documented.

Exhibit 4-63 shows the inputs, processes and outputs for closing contracts and projects and evaluating outcomes.

Exhibit 4-63: Inputs, Processes and Outputs for Closing Contracts and Project and Evaluating Outcomes



Inputs

Outputs from the prior activities become inputs for closing contracts and the project and evaluating outcomes. As such, these inputs may include the project management plan, performance reports, approved/rejected changes and accepted deliverables.

Processes and outputs

The Close Project processes and outputs include the following tasks:

- Close contracts.
- Close projects.
- Evaluate outcomes.

Close contracts

Closure of contracts for contracted resources involves ensuring that all contract specifications have been met and that the deliverables meet the acceptance criteria within tolerance levels.

Contract closure is a management task because judgment is required to ensure that the work is satisfactory and an assessment of the contractor's overall performance is made. It is an administrative task because:

- Terms and conditions of the contract are reviewed and settled.
- Final payments are made and accounted for.
- Contract records and contractor performance records are updated.
- Contracts may need to be terminated early. (However, the approval authority for terminating contracts is typically an executive/client.)

For each contract, the close contract process is performed independently. The process occurs whenever the contract work is complete, so it could happen at any point during a project.

Contract terms and conditions specify the methods by which a contract can be terminated early. Terminating contracts prior to their completion can be by mutual agreement, at will by one or the other party, or by exercising clauses in the contract that show default or noncompliance by one party. Early termination may require legal review and presentation of legal grounds for contract termination. The organization may be legally required to settle with the contractor for monetary expenses already incurred.

When preparing to close a contract, project managers and contract administrators verify and audit:

- Contracted resource scope/statements of work and the procurement management plan.
- The contract, including change orders or amendments.



- Documentation on technical approach.
- The contract's acceptance criteria for deliverables.
- Status and variance reports by milestone.
- Contractor performance reports.

Methods and tools

The following methods and tools can be used for closing contracts:

- **Standardized contract closure procedures and checklists.** Established closure procedures and contract closure checklists are used to ensure that all contract terms and conditions are accounted for.
- **Expert judgment.** Expertise is applied in assessments and legal review.
- **Contractor audits.** Contractor audits include scope verifications, technical audits and financial audits.
- **Procurement audits.** Organizations may internally audit their procurement process to evaluate its efficiency. Contracts may also stipulate an independent audit of contractor processes or deliverables as the work is ongoing. The results may be used in contract closure.
- **Legal review.** Contract closure requires legal review, especially if the contract is terminated early and there is no at-will termination clause.

Documentation

Documentation for contract closure may include the following:

- **Contract closure authorization.** The project manager signs off on the contract, and the contractor receives formal notice of completion.
- **Archived contract.** The contract and its supporting documents are retained, and the contents may be indexed for reference.
- **Design documentation.** Some contracts for construction projects stipulate that the owner receives project designs at the end of the project, such as electronic files of the construction drawings (computer-assisted drafting and design files).
- **Release of liens.** Liens on property exist when work has been performed but contractors or subcontractors have not yet been paid.
- **Documentation for lessons learned.** Lessons learned may include contractor ratings and performance reports, addition or removal of contractors from preselected lists, contracting process or contract detail improvements, and examples of high-quality scope/statements of work.

Close projects

Closing projects is an integration/coordination and administrative task for project managers and/or project administrators.



Closing projects involves:

- Verifying transfer and acceptance of all final deliverables to owners or responsible parties (as discussed previously).
- Closing remaining contracts (as discussed previously).
- Issuing formal acceptance documentation.
- Releasing project team members.
- Generating project files such as operation and maintenance manuals, project records, warranty information, electronic drawings and closure documents.

The project manager reviews the project management plan, the contract closure process, performance reports, quality reports, and deliverable inspection, transfer and acceptance reports prior to closing projects. Documentation from each project management process is forwarded to project closure, as noted previously.

Methods and tools

The following methods and tools can be used for closing projects:

- **Standardized project closure procedures and checklists.** Established closure procedures and checklists ensure that all tasks are completed.
- **Expert judgment.** Expertise is applied in assessments and legal review.
- **Project audits.** Organizations may internally audit their project management process to evaluate its efficiency.
- **Project management technology.** Project management software retains project data in electronic records and archive printouts can be made.

Documentation

Documentation for closing projects may include the following:

- **Archived project files.** The project objectives statement, designs and drawings, project management plan in its original and modified states, and other data such as approved/rejected changes are archived. Archives are retained for the following reasons:
 - Reference for future projects to improve or configure deliverables
 - Benchmark for future cost or time estimates for work packages
 - Records for taxes, financial or process audits, or potential litigation
 - Training and development and outcome evaluation
- **Product documentation.** Product documentation may include operations and maintenance manuals, warranties, maintenance contracts, electronic drawings, etc.



- **Project closure documentation.** Project closure documentation formally ends the project and releases team members and equipment. Documents for projects terminated prior to completion indicate the reason for termination and how to transfer complete or incomplete deliverables.

Evaluate outcomes Evaluating outcomes ensures that the organization learns from the successes and failures of the project. It may involve:

- Conducting an outcome evaluation to determine the success or failure of the project, the root causes of the success/failure and the lessons learned.
- Evaluating the performance of the project manager and the project team.
- Evaluating the performance of contracted resources (addressed earlier).
- Using project outcome documentation to train new project managers or staff or develop the skills of existing project managers and staff.
- Conducting occupancy surveys to measure satisfaction with facilities.
- Producing a final report.
- Celebrating success.

The Evaluate Outcomes process is the most likely task to be omitted from a project, even though it produces benefits that are likely to outweigh the additional effort. Common reasons for this resistance include the following:

- **Evaluation occurs at the end of the project.** Project managers and teams may be immediately transferred to regular work or another project.
- **Lack of understanding of the value of the evaluation.** Senior management may not see the value in the evaluation or wish to fund it.
- **Lack of motivation to conduct an evaluation.** Psychological elements of relief after a stressful project make it difficult to motivate staff to perform this additional work.
- **No desire to revisit failures.** Project managers and team members may not want to draw attention to failures and rationalize this desire by implying it is too late to change the past.

Project managers use leadership skills to overcome resistance to outcome evaluations.

When preparing to evaluate outcomes, project managers or evaluators review the original and final state of the project objectives statement, the project management plan, and contract documentation. They also review current project management policies, procedures and practices such as organizational hierarchies to determine what changes to suggest.



Methods and tools

The following methods and tools can be used in evaluating projects:

- **Project audits.** Project audits are independent reviews of projects that can provide valuable information for lessons learned. For example, a project audit can be used to compare preliminary estimates to final estimates.
- **Pre- and post-occupancy surveys or post-occupancy evaluations (POEs).** These are surveys conducted following project completion to assess the occupants' level of satisfaction with the various aspects of the new working environment as well as to check performance against the specifications of the major systems. Occupancy surveys conducted pre- and post-relocation can measure the increase in customer satisfaction with the new space. Occupancy surveys can be online and can be used to show where facilities are over- or under-delivering on services and help make occupants aware of services.
- **Outcome evaluations or post-implementation audits.** Outcome evaluations analyze relative project success in evaluation metrics such as the following:
 - **Achievement of the project's purpose and success criteria.** The project's purpose and success criteria are tested against the actual results to determine if the project solves the original problem. This is the primary determinant of project success.
 - **Scope variance.** The significance of variances from the schedule, budget, quality and overall scope is assessed.
 - **Client or owner satisfaction.** Even if the purpose and scope are satisfied, the client or owner may not be satisfied. If not, it may be due to a misunderstanding of the purpose or a change in priorities that was not communicated effectively.
 - **Action and change order analysis.** Midproject changes are assessed to determine changes that can be included in the original plans of future projects rather than requiring midproject change; changes that were accepted but should have been rejected or vice versa; whether the project's purpose was adequately communicated to stakeholders (e.g., numerous rejected change requests); and recommendations for avoiding change order situations.



- **Root cause analysis.** The root cause of successes and failures can be analyzed using a variety of quality tools. Analysis may reveal mixed results. For example, a project may have failed despite successful teamwork or a success may have occurred despite poor project management.
- **Business value.** Analysis of the financial or project benefits can be measured against what was promised. A tool such as the balanced scorecard (discussed below) can measure business value. It may not be possible to measure business value until sufficient time has passed.
- **Balanced scorecard.** The balanced scorecard can provide a comprehensive view of the business value provided by a project. Evaluators use a scorecard to categorize goals and measurements according to four perspectives:
 - **Customer perspective**—Customer-related goals could include end user satisfaction with deliverables or maintenance support.
 - **Business process perspective**—Business process goals could measure productivity increases or maintainability of deliverables.
 - **Innovation and learning perspective**—Innovation and learning goals could measure how well the project contributes to organizational strategy or to the skills acquired by participants.
 - **Financial perspective**—Financial goals could measure return on investment, payback period, or other bottom-line results.
- **Lessons learned.** Lessons learned summarize the effect of decisions made on a project and serve as a guide for what to repeat and what to avoid on future projects. The lessons are applied to update policies, procedures and practices such as document and contract templates or project organizational charts. Lessons learned can also take the form of helpful hints, for example, how and when to apply a specific technique.
- **Project management technology.** Project management software may facilitate indexing outcome evaluation materials for easier reference.



- **Celebrations.** The project manager may organize an event or party to congratulate the project team on their performance.
- **Commemorative gifts.** Commemorative gifts such as labeled mugs or T-shirts can show appreciation and inspire greater company loyalty.

Documentation

Documentation resulting from evaluating outcomes may include the following:

- **Updates to the project management process.** Continual improvement to the processes of defining, planning, doing, checking, acting and closing a project can increase the chances of success for future projects.
- **Updates to policies, procedures or practices for projects.** Policies, procedures and practices are updated as approved and appropriate.
- **Performance assessments.** Informal performance assessments for staff and contractors are retained in notes/discussed with line managers.
- **Updates to “lessons learned” archive.** Helpful hints and the likely result of particular actions can be edited from project to project and used to help train new project managers.
- **Updates to project templates and standardized forms.** Changes that were made to templates and forms may be applied to future projects.
- **Updates to quality and performance metrics.** Measurements that were considered useful are retained and areas that need more (or less) measurement are determined along with tool recommendations.
- **Communications to all involved stakeholders of project results and process changes.** The results of the outcome evaluation, lessons learned, and changes to future processes are communicated to stakeholders in a meeting or report to continually improve all project participants rather than producing a report just for the project manager and executives.



Progress Check Questions

Directions: Read each question and respond in the space provided. Answers and page references follow the questions.

1. Why is an informal walk-through of a construction site performed prior to the formal walk-through?
(Select two answers.)
☐ a. To see that all work appears complete including all areas prepared for owner-furnished items
☐ b. To ensure the site is clean
☐ c. To verify that all contractor tools have been removed
☐ d. To find and document all defects in finished work
2. Which of the following provides validation of deliverables that need correcting?
☐ a. Project management software
☐ b. Team member originally responsible for the work
☐ c. Quality assurance
☐ d. Quality control
3. Once formal acceptance takes place, deliverables become
☐ a. the construction project manager's responsibility.
☐ b. the project manager's responsibility.
☐ c. the owner's responsibility.
☐ d. the quality control person's responsibility.
4. Finished deliverables for a construction project are found to be deficient but are repaired and validated. If the owner is still not satisfied, which of the following occurs?
☐ a. Correction and validation continue to occur until the owner is satisfied or the project is cancelled.
☐ b. The project is closed regardless of whether the owner is satisfied.
☐ c. Correction and validation can occur once more, but if validation is successful, the project is closed even if the owner is not satisfied.
5. Which of the following is a process to ensure that a building's performance is in harmony with the intent of its design and the operational needs of its owner?
☐ a. Commissioning
☐ b. Warranty
☐ c. Retainage
☐ d. Certificate of occupancy



6. Which of the following is used to ensure that a project is free from liens at project completion?
 - ☐ a. Commissioning
 - ☐ b. Retainage
 - ☐ c. Warranty
 - ☐ d. Maintenance agreements

7. How can termination of contracts prior to their completion be accomplished? *(Select two answers.)*
 - ☐ a. By mutual agreement
 - ☐ b. At will by one or the other party without risk of being legally required to pay for incurred monetary expenses
 - ☐ c. By exercising clauses in the contract that show default or noncompliance by one party

8. Which of the following could be conducted both before and after a relocation to measure the increase in satisfaction with the new space?
 - ☐ a. Action and change order analysis
 - ☐ b. Balanced scorecard innovation and learning perspective
 - ☐ c. Root cause analysis
 - ☐ d. Occupancy surveys

9. In a construction project punch-list review, which of the following is true?
 - ☐ a. Project managers should point out every flaw, no matter how minor, and get them fixed.
 - ☐ b. Project managers complete the punch list on their own.
 - ☐ c. Incomplete work on the site is acceptable if they are areas prepared for owner-furnished items.
 - ☐ d. The site will still have substantial debris and construction tools that need to be avoided.

10. Which of the following is true of outcome evaluation?
 - ☐ a. Business value analysis is best conducted immediately upon project completion.
 - ☐ b. Action and change order analysis tries to minimize change order situations in future projects.
 - ☐ c. Outcome evaluation reports are developed for the project manager and executives only.
 - ☐ d. Root cause analysis is performed only for project failures.



Progress check answers

1. b, c (p. 4-272)
2. d (p. 4-273)
3. c (p. 4-271)
4. a (p. 4-271)
5. a (p. 4-274)
6. b (p. 4-275)
7. a, c (p. 4-277)
8. d (p. 4-281)
9. c (p. 4-272)
10. b (p. 4-281)

Next Steps

You have completed this competency of the IFMA Facility Management Learning System. Next, check your understanding by completing the online competency-specific chapter quizzes and case study to help you identify any concepts that need additional study. Check your understanding another way by selecting the competency-specific eFlashcards, or visit the Resource Center to download printable flashcards.

Once you have completed the chapter quizzes, reviewed the eFlashcards, completed the case study and feel confident that you have mastered the information, you can advance to the next competency.

