Introduction to the Project Management Knowledge Areas

Quality   Risk   Project Scope   Costs   Procurement

> **LEARNING OBJECTIVES**
>
> 1. Identify the tasks performed in a project start-up.
> 2. Describe the areas of project management knowledge as defined by the Project Management Institute.

Project Start-up and Integration

During project start-up, the project management team refines the scope of work and develops a preliminary schedule and conceptual budget. The project team builds a plan for executing the project based on the project profile (project profiles are defined more fully in chapter 2). The plan for developing and tracking the detailed schedule, the procurement plan, and the plan for building the budget and estimating and tracking costs are developed during the start-up. The plans for information technology, communication, and tracking client satisfaction are all developed during the start-up phase of the project.

Flowcharts, diagrams, and responsibility matrices are tools to capture the work processes associated with executing the project plan. The first draft of the project procedures manual captures the historic and intuitional knowledge that team members bring to the project. The development and review of these procedures and work processes contribute to the development of the organizational structure of the project.

This is typically an exciting time on a project where all things are possible. The project management team is working many hours developing the initial plan, staffing the project, and building relationships with the client. The project manager sets the tone of the project and sets expectations for each of the project team members. The project start-up phase on complex projects can be chaotic, and until plans are developed, the project manager becomes the source of information and direction. The project manager creates an environment that encourages team members to fully engage in the project and encourages innovative approaches to developing the project plan.

Project Scope

The project scope is expressed in a document that defines the **_parameters_**—factors that define the project and determine its behavior—what work is done within the boundaries of the project, and the work that is outside the project boundaries. The **_scope of work (SOW)_** is typically a written document that defines what work will be accomplished by

the end of the project—the deliverables of the project. The project scope defines what will be done, and the **_project execution plan_** defines how the work will be accomplished.

No template works for all projects. Some projects have a very detailed scope of work, and some have a short summary document. The quality of the scope is measured by the ability of the project manager and project stakeholders to develop and maintain a common understanding of what products or services the project will deliver. The size and detail of the project scope is related to the complexity profile of the project. A more complex project often requires a more detailed and comprehensive scope document.

According to the Project Management Institute, a complete statement of the scope should include the following: [1]

- Description of the scope
- Product acceptance criteria
- Project deliverables
- Project exclusions
- Project constraints
- Project assumptions

The scope of work is the basis for agreement by all parties. A clear project scope document is also critical to managing change on a project. Since the project scope reflects what work will be accomplished on the project, any change in expectations that is not captured and documented creates the opportunity for confusion. One of the most common trends in projects is the incremental expansion in the project scope, which is called **_scope creep_**. Scope creep threatens the success of a project because the small increases in scope require additional resources that were not in the plan. Increasing the scope of the project is a common occurrence, and adjustments are made to the project budget and schedule to account for these changes. Scope creep occurs when these changes are not recognized or not managed. The ability of a project manager to identify potential changes is often related to the quality of the scope documents.

Events occur that require the scope of the project to change. Changes in the marketplace may require change in a product design or the timing of the product delivery. Changes in the client's management team or the financial health of the client may also result in changes in the project scope. Changes in the project schedule, budget, or product quality will have an effect on the project plan. Generally, the later in the project the change occurs, the greater the increase to the project costs. Establishing a system for managing change during the project that captures changes to the project scope and assures that these changes are authorized by the appropriate level of management in the client's organization is the responsibility of the project manager. The project manager also analyzes the cost and schedule impacts of these changes and adjusts the project plan to reflect the changes authorized by the client. Changes to the scope can cause costs to increase or decrease.

Project Schedule and Time Management

The definition of project success often includes completing the project on time. The development and management of a project schedule that will complete the project on time is a primary responsibility of the project manager, and completing the project on time requires the development of a realistic plan and the effective management of the plan. On smaller projects, project managers may lead the development of the project plan and build a schedule to meet that plan. On larger and more complex projects, a project controls team that focuses on both costs and schedule planning and controlling functions will assist the project management team in developing the plan and tracking progress against the plan.

To develop the project schedule, the project team does an analysis of the project scope, which is incorporated into the contract, and other information that helps the team define the project deliverables. Based on this information, the project team develops a **_milestone schedule_**. The milestone schedule establishes key dates throughout the life of a project that must be met for the project to finish on time. The key dates are often established to meet contractual obligations or established intervals that will reflect appropriate progress for the project. For less complex projects, a

milestone schedule may be sufficient for tracking the progress of the project. For more complex projects, a more detailed schedule is required.

To develop a more detailed schedule, the project team first develops a **work breakdown structure (WBS)**—a description of tasks arranged in layers of detail. Although the project scope is the primary document for developing the WBS, the WBS incorporates all project deliverables and reflects any documents or information that clarifies the project deliverables. From the WBS, a project plan is developed. The project plan lists the activities that are needed to accomplish the work identified in the WBS. The more detailed the WBS, the more activities that are identified to accomplish the work.

After the project team identifies the activities, the team then sequences the activities according to the order in which the activities are to be accomplished. An outcome from the work process is the **project logic diagram**. The logic diagram represents the logical sequence of the activities needed to complete the project. The next step in the planning process is to develop an estimation of the time it will take to accomplish each activity or the activity duration. Some activities must be done sequentially, and some activities can be done concurrently. The planning process creates a project schedule by scheduling activities in a way that effectively and efficiently uses project resources and completes the project in the shortest time.

On larger projects, several paths are created that represent a sequence of activities from the beginning to the end of the project. The longest path to the completion of the project is the **critical path**. If the critical path takes less time than is allowed by the client to complete the project, the project has a positive total **float** or project **slack**. If the client's project completion date precedes the calculated critical path end date, the project has negative float. Understanding and managing activities on the critical path is an important project management skill.

To successfully manage a project, the project manager must also know how to accelerate a schedule to compensate for unanticipated events that delay critical activities. Compressing – **crashing** – the schedule is a term used to describe the techniques used to shorten the project schedule. During the life of the project, scheduling conflicts often occur, and the project manager is responsible for reducing these conflicts while maintaining project quality and meeting cost goals.

Project Costs

The definition of project success often includes completing the project within budget. Developing and controlling a project budget that will accomplish the project objectives is a critical project management skill. Although clients expect the project to be executed efficiently, cost pressures vary on projects. On some projects, the project completion or end date is the largest contributor to the project complexity. The development of a new drug to address a critical health issue, the production of a new product that will generate critical cash flow for a company, and the competitive advantage for a company to be first in the marketplace with a new technology are examples of projects with schedule pressures that override project costs.

The accuracy of the project budget is related to the amount of information known by the project team. In the early stages of the project, the amount of information needed to develop a detailed budget is often missing. To address the lack of information, the project team develops different levels of project budget estimates. The **conceptual estimate** (or "ballpark estimate") is developed with the least amount of knowledge. The major input into the conceptual estimate is expert knowledge or past experience. A project manager who has executed a similar project in the past can use those costs to estimate the costs of the current project.

When more information is known, the project team can develop a **rough order of magnitude (ROM)** estimate. Additional information such as the approximate square feet of a building, the production capacity of a plant, and the approximate number of hours needed to develop a software program can provide a basis for providing an ROM estimate. After a project design is more complete, a project **detailed estimate** can be developed. When the project team knows the number of rooms, the type of materials, and the building location of a home, the project team can provide a detailed estimate. A detailed estimate is not a bid.

The cost of the project is tracked relative to the progress of the work and the estimate for accomplishing that work. Based on the cost estimates, the cost of the work performed is compared against the cost budgeted for that work. If the cost is significantly higher or lower, the project team explores reasons for the difference between expected costs and actual costs.

Project costs may deviate from the budget because the prices in the marketplace were different from what was expected. For example, the estimated costs for lumber on a housing project may be higher than budgeted or the hourly cost for labor may be lower than budgeted. Project costs may also deviate based on project performance. For example, the project team estimated that the steel design for a bridge over the Hudson River would take 800 labor hours, but 846 hours were actually expended. The project team captures the deviation between costs budgeted for work and the actual cost for work, revises the estimate as needed, and takes corrective action if the deviation appears to reflect a trend.

The project manager is responsible for assuring that the project team develops cost estimates based on the best information available and revises those estimates as new or better information becomes available. The project manager is also responsible for tracking costs against the budget and conducting an analysis when project costs deviate significantly from the project estimate. The project manager then takes appropriate corrective action to assure that project performance matches the revised project plan.

Procurement

The procurement effort on projects varies widely and depends on the type of project. It can range from less complex projects where the project team identifies the materials, product specifications and a detailed delivery schedule to the client; to the parent company providing procurement services via a liaison; to a procurement team being hired.

At the end of the project, equipment bought or rented for the execution of the work of the project are sold, returned to rental organizations, or disposed of some other way.

The procurement process may involve commodities, vendors, suppliers, and partners. The awarding of a contract can include price, ability to meet the project schedule, the fit for purpose of the product, and other considerations important to the project.

Project Quality

Project quality focuses on the end product or service deliverables that reflect the purpose of the project. The project manager is responsible for developing a project execution approach that provides for a clear understanding of the expected project deliverables and the quality specifications. The project manager of a housing construction project not only needs to understand which rooms in the house will be carpeted but also what grade of carpet is needed. A room with a high volume of traffic will need a high-grade carpet.

The project manager is responsible for developing a project quality plan that defines the quality expectations and assures that the specifications and expectations are met. Developing a good understanding of the project deliverables through documenting specifications and expectations is critical to a good quality plan. The processes for assuring that the specifications and expectations are met are integrated into the project execution plan. Just as the project budget and completion dates may change over the life of a project, the project specifications may also change. Changes in quality specifications are typically managed in the same process as cost or schedule changes. The impact of the changes is analyzed for impact on cost and schedule, and with appropriate approvals, changes are made to the project execution plan.

The PMBOK has an extensive chapter on project quality management. The material found in this chapter would be similar to material found in a good operational management text. Although any of the quality management techniques designed to make incremental improvement to work processes can be applied to a project work process, the character of a project (unique and relatively short in duration) makes small improvements less attractive on projects.

Rework on projects, as with manufacturing operations, increases the cost of the product or service and often increases the time needed to complete the reworked activities. Because of the duration constraints of a project, the development of the appropriate skills, materials, and work process early in the project is critical to project success. On more complex projects, time is allocated to developing a plan to understand and develop the appropriate levels of skills and work processes.

Project management organizations that execute several similar types of projects may find the process improvement tools useful in identifying and improving the baseline processes used on their projects. Process improvement tools may also be helpful in identifying cost and schedule improvement opportunities. Opportunities for improvement must be found quickly to influence project performance. The investment in time and resources to find improvements is greatest during the early planning stages of the project. During later project stages, as pressures to meet project schedule goals increase, the culture of the project is less conducive to making changes in work processes.

Another opportunity for applying process improvement tools is on projects that have repetitive processes. A housing contractor that is building several identical houses may benefit from evaluating work processes in the first few houses to explore the opportunities available to improve the work processes. The investment of $1,000 in a work process that saves $200 per house is a good investment as long as the contractor is building more than five houses.

Project Team

Staffing the project with the right skills, at the right place, and at the right time is an important responsibility of the project management team. The project usually has two types of team members: functional managers and process managers. The **functional managers** and team focus on the technology of the project. On a training project, the functional manager would include the professional trainers; on an information technology project, the software development managers would be functional managers. The project management team also includes project **process managers**. The project controls team would include process managers who have expertise in estimating, cost tracking, planning, and scheduling. The project manager needs functional and process expertise to plan and execute a successful project.

Because projects are temporary, the staffing plan for a project typically reflects both the long-term goals of skilled team members needed for the project and short-term commitment that reflects the nature of the project. Exact start and end dates for team members are often negotiated to best meet the needs of individuals and the project. The staffing plan is also determined by the different phases of the project. Team members needed in the early or conceptual phases of the project are often not needed during the later phases or project closeout phases. Team members needed during the execution phase are often not needed during the conceptual or closeout phases. Each phase has staffing requirements, and the staffing of a complex project requires detailed planning.

Typically a core project management team is dedicated to the project from start-up to closeout. This core team would include the following members: project manager, project controls, project procurement, and key members of the function management or experts in the technology of the project. Although longer projects may experience more team turnover than shorter projects, it is important on all projects to have team members who can provide continuity through the project phases.

Project team members can be assigned to the project from a number of different sources. The organization that charters the project can use any number of staffing options, such as assigning managers and staff from functional units within the organization, contracting with individuals or agencies to staff positions, temporarily hiring staff for the project, or a combination of these. This staffing approach allows the project manager to create the project organizational culture. Some project cultures are more structured and detail oriented, and some are less structured with less formal roles and communication requirements. The type of culture the project manager creates depends greatly on the type of project.

Communications

Completing a complex project successfully requires teamwork, and teamwork requires good communication among team members. If those team members work in the same building, they can arrange regular meetings, simply stop by each other's office space to get a quick answer, or even discuss a project informally at other office functions. Many complex projects in today's global economy involve team members from widely separated locations, and the types of meetings that work within the same building are not possible. Teams that use electronic methods of communicating without face-to-face meetings are called ***virtual teams***.

Communications technologies require a variety of compatible devices, software, and service providers, and communication with a global virtual team can involve many different time zones. Establishing effective communications requires a communications plan.

Project Risk

Risk exists on all projects. The role of the project management team is to understand the kinds and levels of risks on the project and then to develop and implement plans to mitigate these risks. Risk represents the likelihood that an event will happen during the life of the project that will negatively affect the achievement of project goals. The type and amount of risk varies by industry type, complexity, and phase of the project. The project risk plan will also reflect the risk profile of the project manager and key stakeholders. People have different comfort levels with risk, and some members of the project team will be more risk adverse than others.

The first step in developing a risk management plan involves identifying potential project risks. Some risks are easy to identify, while others are less obvious. Many industries or companies have risk checklists developed from past experience. However, no risk checklist will include all potential risks. The value of a checklist is the stimulation of discussion and thought about the potential risks on a project.

The project team then analyzes the identified risks and estimates the likelihood of the risks occurring. The team then estimates the potential impact of project goals if the event does occur. The outcome from this process is a prioritized list of estimated project risks with a value that represents the likelihood of occurrence and the potential impact on the project.

The project team then develops a risk mitigation plan that reduces the likelihood of an event occurring or reduces the impact on the project if the event does occur. The risk management plan is integrated into the project execution plan, and mitigation activities are assigned to the appropriate project team member. The likelihood that all the potential events identified in the risk analysis would occur is extremely rare. The likelihood that one or more events will happen is high.

The project risk plan reflects the risk profile of the project and balances the investment of the mitigation against the benefit for the project. The plan includes periodic risk plan reviews during the life of the project. The risk review evaluates the effectiveness of the current plan and explores for possible risks not identified in earlier sessions.

KEY TAKEAWAYS

- During the start-up phase, the project leader develops the project infrastructure used to design and execute the project. A team is formed to create agreement among project stakeholders on the goals, cost, and completion date. Plans for executing the project by managing the schedule, quality, and budget are created.
- The SOW establishes project parameters that define what will be done.
- The project schedule begins with a milestone schedule followed by a WBS and a project diagram. The longest path through the project diagram is the critical path, and the difference between the completion of the critical path and the project finish date is the float. Shortening the critical path is called crashing the project.
- Cost estimating begins with a conceptual or ballpark estimate that is followed by a ROM estimate. A project budget is determined from the cost of the tasks in the WBS. Costs are monitored during the project and estimates updated if the costs vary from expectations.
- The provider of procurement management depends on the size of the project and the organization. Commodities are purchased through vendors, suppliers or partners.
- Project quality begins with the specifications of materials and labor. A quality plan creates a process for assuring the requirements and specifications of the project are met. Quality improvement tools can be applied to projects if the company has several similar projects.
- Team members are selected to manage functions and processes. The staffing plan assigns people as needed. Sources of team members are company employees, contractors, new hires, and partners.
- The risk on a project reflects the number of things that can possibly happen that will have a negative effect on the project and the probability of those events happening.

[1] Project Management Institute, Inc., A Guide to the Project Management Body of Knowledge (PMBOK Guide), 4th ed. (Newtown Square, PA: Project Management Institute, Inc., 2008), 115–16.