The Rational Project Manager

A THINKING TEAM'S GUIDE TO GETTING WORK DONE

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project definition

Moving the Corporate Customer Services Department will be a huge undertaking. Although the project manager, Tim Dwight, has seven years of experience in managing complex projects, the rest of the project team is new to the project management game. What's more, many team members hold a personal stake in the outcome of the project; they are members of the Corporate Customer Services Department.

During the first project team meeting, Tim explains the decision by the company's Executive Committee to move Corporate Customer Services. As the team already knows, an old building houses the current offices, and it's not equipped to meet the department's increased technological needs. In addition, Tim tells the group, the Executive Committee recently agreed to expand the department by adding 45 new people within the next year. The new office provides extra space for the already cramped department and leaves room for the upcoming growth, as well as some additional future expansion. It also allows the company to upgrade the technological capabilities of the department and its work environment. New furniture and décor will be part of the plan.

By the end of the meeting, the group knows that they have three months to plan and conduct the move, and that the budget, provided to them by the Executive Committee, is $170,000. They also understand the need for a smooth, well-managed move and the reasons behind the deadline.

WHY ARE WE DOING THIS PROJECT?

Too often, project teams begin to plan a project before they have taken the time to truly consider why they are doing it, how they are going to do it, and what it's going to take to get it done. There is a tendency to start out by building Gantt charts—project management software prompts this behavior—without considering the fundamental purpose of the project. Jumping to the creation of time lines is often the first, wrong step taken by project teams destined for trouble.

So think about—and then answer—the "why" question before you jump into project planning. If you need some help, consider the following:

- The reasons why the project is necessary for your department, organization, client, community, or yourself.
- The overall purpose of the project.
- The threats, opportunities, and needs that are driving the project.

Capture this "why" information as background for the project. You'll use it as you create a project statement and develop objectives, and you may decide to also use it to demonstrate the thinking that occurred prior to the start of the project.

With your background information in hand, you're ready to start the first part of the project management process—Definition. During Definition, you'll answer four basic questions:

1. What is the project statement?
2. What are the project objectives?
3. What needs to be accomplished to complete the project?
4. What resources are needed to complete the project?

TIP

Sometimes background information may be provided to you by senior management in a *project charter* or a signed contract. Such a document formally recognizes the existence of the project and gives the project manager the authority to spend resources on project activities. The charter or contract will include the business need for undertaking the project and the results to be delivered. It will also include preliminary product/service descriptions that will have to be refined as the project progresses.

This information will provide you and your project team with a framework that will guide the planning and implementation of your project.

Four activities will help you find answers to these questions:

1. State the Project.
2. Develop Objectives.
3. Develop the *Work Breakdown Structure* (WBS).
4. Identify Resource Requirements.

STATE THE PROJECT

Stating the project is the first step in Definition. A *project statement* is a clear, concise phrase that describes the project's overall goal, as well as its time and cost boundaries.

TIP

If you are struggling to come up with time and cost information for your project statement, use ballpark figures until you can get better information. This technique will prompt others to audit your figures and provide you with a better time frame or a more realistic cost.

"Move the Corporate Customer Services Department within three months at a cost not to exceed $170,000" is an example of a project statement. We use this example throughout this book. The project statement contains three elements: (1) An action word with an end result (this is called the *performance* element); (2) a target date for completion (the *time* element); and (3) an overall project cost (the *cost* element). A triangle often serves as a visual representation of these three elements, indicating the need to balance all three.

Take note: The project statement is not merely a group of words; the three elements shouldn't be plucked from the sky, nor should they be a product of one person's or one group's demands. Instead, the project statement should reflect, at a very high level, the reason for doing the project.

TIP

Use the project statement as a communication tool by keeping it visible on all project documentation.

To accurately assess project timing, consider how much time it has taken your organization to complete similar projects in the past. In addition, think about when you'll

PITFALL

Don't be overly influenced by the time and cost of similar projects you've managed in the past. If your current need requires completing the project significantly faster, at less cost, or at a different quality level, then design the work or solution differently from previous projects.

need to complete the project in order to gain or optimize its benefit.

You may be uncertain about including a budget limit in your project statement. However, it makes good sense to do so even at this early stage. By examining cost realistically, you can change the end result—or even the scope—of your project. For example, after estimating how much the project will cost, you may discover that the expected benefit does not justify the cost of the project. If you're struggling to calculate the cost of a project, don't take a wild guess. Instead, wait until later in Definition or Planning (when you'll have factored in the specific cost of resources).

Developing a project statement will focus members of the team on the intended outcome of the project. That ensures that everyone involved has the same understanding of what the project will accomplish, by when, and for how much.

Join Together

When you develop the project statement, involve project team members, key contributors, key stakeholders (including sponsors and functional managers), customers, and experts. Refer to the descriptions of each group:

- *Project team members:* People designated by you or someone else to be on the project team. The project team usually produces the bulk of the project work.
- *Contributors:* People who are not on the project team but who are asked to contribute their time and/or effort to the project.
- *Stakeholders:* People who are impacted by the project now—or will be in the future. Some stakeholders will exert enormous

influence on the project, like sponsors who typically provide the political, financial, and logistical support, champion the project, and approve the results; others, like functional managers, provide human and other resources such as equipment, facilities, and so on.

- *Customers:* People for whom the project results are produced; they can be internal or external customers and usually are also considered stakeholders.
- *Experts:* (Also known as subject matter experts or SMEs), these individuals hold special experience, knowledge, or skills that relate to the planning or implementation of the project. They're also considered contributors.

You'll need the commitment and involvement of all of these groups to the project. For example, they may possess critical information that you need to formulate the project statement. Including them in your discussions will increase the probability of winning their commitment and harnessing their knowledge up front . . . and throughout the life of the project.

TIP

Even after you've agreed on a project statement with everyone involved, you may need to revise it during the Definition and Planning stages. Proceed with the revision if it improves the accuracy and relevancy of your project statement.

However, keep in mind that gaining agreement on a project statement may not always be easy, especially if the need for the project (and its value) is not clearly understood among the people involved. If necessary, tap into the list of threats and opportunities that the project will address (you prepared this list prior to Definition), and present it to those involved in project statement discussions. This will demonstrate your thinking, compare it to the thinking and expectations of others, and focus attention on a project statement that best represents what the project should accomplish. Situation Appraisal is a rational and effective method for identifying, clarifying, and prioritizing threats and opportunities. This method is described in more detail on page 176.

The More You Know . . .

It's possible that several different projects could address the same set of needs. If this is the case, develop a project statement for each project. Then, compare the project statements and select the one that will best meet your needs with the least amount of risk and potential adverse consequences. (Keep in mind that you may be forced to go further into the definition and planning of each project to make a fair and accurate comparison. If you invest the time to do this, try combining details of several different projects to create a superior hybrid.) For more information on choosing between alternatives, see page 181 on Decision Analysis.

Before you move to the next activity, take a step back and critically assess your project statement. Are you certain that the project should be undertaken? Are you sure that the project, stated as is, will meet the need or resolve the concern? Confirming that your organization should, in fact, do the project—and that the project will meet the need—is the first step toward a successful project.

DEVELOP OBJECTIVES

At the outset, we recommended that you think about and record the reasons why you're doing this project. Now you'll develop *objectives,* the next activity in Definition. Objectives will further clarify and expand on the reasons for undertaking this project.

TIP

Objectives should communicate the specific value the project will deliver, *not* how the project will be completed.

Project objectives should be written as short statements and should describe (1) specific results and value that the project will deliver and (2) constraints within which the project must be completed.

To develop project objectives that represent *results,* ask the following questions:

1. What do you want to have at the end of the project in terms of benefits or capabilities?
2. What value should the project produce?

3. How will you know when you satisfy each objective? (measure and standard)
4. What short- and long-term benefits do you want?

Your answers will reflect things like: impact on market size, market share or margin; customer satisfaction; quality levels; business and financial results; technological innovations or trends; organizational issues; and facilities and equipment usage. (For a complete list to consider when developing objectives, review box topic 2.1, Helping You Develop Objectives on pages 28–29.)

Example 2.1 on page 30 shows objectives developed for the project statement, "Move the Corporate Customer Services Department within three months at a cost not to exceed $170,000." Objectives 1 through 4 represent results.

Project objectives that represent *constraints* will expand on the boundaries that you set in the project statement and will also consider other restrictions. To write project objectives that represent constraints, ask the following questions:

- What requirements must be met?
- What constraints, restrictions, or resource limitations do we face?
- What resources should be used or saved?

Each project objective should contain a clear measure and standard of performance. Try including the phrase, "as shown by . . ." or "as measured by . . ." at the end of each objective. Then, complete the phrase with information on how you expect to measure the objective and what level of performance you expect, such as a specific number or an agreed-upon value. For example, if your objective is to "Maximize the ability to quickly revise future office layouts," then you can measure the objective by the total number of hours it will take to revise the layout for a workstation and set the standard at "not more than _____ hours per workstation." Or, you can measure the objective by the total cost to revise the layout for a workstation and set the standard at "not more than _____ cost per workstation." Metrics

BOX TOPIC 2.1

Helping You Develop Objectives

Project objectives are critical to a successful project outcome because they establish the criteria that you'll use to make decisions about the project and guide the project team.

If you're struggling to compile a complete list of objectives or if you want to brainstorm additional objectives to make sure you have thought of everything, use the following list to stimulate your thinking. For each thought-starter, ask yourself, "How should (thought-starter) influence my choice?"

Thought-Starters for Developing Objectives

Human Resources

Motivation and attitudes
Skills and ability
Performance and productivity
Development and growth
Health and safety
Equal rights and opportunities

Facilities and Equipment

Space
Flexibility and adaptability
Location
Compatibility

Organization

Relationships among units, functions, individuals
Discussions
Responsibility and delegation
Formal and informal organization
Coordination
Information systems

Material

Sources and availability
Quality
Grade
Handling and storage

External Influences

Economic trends
Competition
Vendors and contractors
Company image, positioning
Law and government
Environment
Community
Technology

Output

Quality
Quantity
Pace and timing
Distribution

Money

Capital or fixed costs and expenses
Support, maintenance, and life cycle costs
Price
Margin or profit
Return

BOX TOPIC 2.1 Continued

Ideas and Process

Security, proprietary position
Knowledge capture and retrieval
Research
Capabilities
Networks

Strategy

Competitive advantage
Target market
Product platforms and mix
Market size
Market share
Key strategic indicators

Time

Life span of project
Life span of output
Time to first return

Customers

Marketing
Sales
Support
Location

Personal

Goals and plans
Family
Strengths and weaknesses
Interests
Values and beliefs

like these give the people who have to revise the layout a very precise idea of the scope of the work.

Again, review the project objectives in Example 2.1. Objectives 5 through 13 are constraints.

Most projects will have more objectives dedicated to results than to constraints, but this isn't a universal formula. Some projects will require you to work within very strict boundaries (many constraints), while others will be entirely flexible (few or no constraints).

The primary reason for developing objectives is to provide you and other project participants with a basis for defining the specific work that needs to be done to complete the project. However, project objectives also focus the project team by guiding their decisions and offer other interested stakeholders and customers a summary of the project's intent.

Example 2.1 Project Objectives

Project Statement

Move the Corporate Customer Services Department within three months at a cost not to exceed $170,000.

Project Objectives

At the end of the project, we will have:

1. Maximized the ability to quickly revise future office layouts.
2. Minimized barriers to information flows (including voice, data, document, and interpersonal communication) among department offices.
3. Minimized overall traffic by creating the shortest, most direct traffic flows within office space.
4. Provided for current and future storage space.
5. Met corporate requirements for minimum office floor space; lighting levels; heating, ventilation, and air conditioning (HVAC); background-noise levels; workspace ergonomics.
6. Not exceeded $100,000 in external costs for moving equipment and furnishings.
7. Completed the move within three months.
8. Maximized effective use of existing equipment.
9. Not interrupted current customer requirements and workload.
10. Not exceeded $70,000 for new equipment and office furnishings.
11. Fit office layouts within allocated office area.
12. Brought all computer and telecommunication equipment up to corporate standards.
13. Complied with government safety and health regulations.

Join Together

The project communication that began around the project statement should continue while you are developing objectives. Once again, securing the commitment and experience of your project team members, stakeholders, customers, experts, and key contributors will be critical to the success of your project. Individuals in each group can contribute to the development of objectives in several ways—by sur-

facing the original ideas, writing the objectives, refining the objectives, suggesting ways to measure the objectives, or reviewing the entire list of objectives. However, it's critical that you, as the project manager, ensure the list of objectives is reasonable and accurately reflects the value your customers expect to receive from the project.

TIP

When developing objectives with large groups of people, using creative techniques such as brainstorming or *Nominal Group Technique* (NGT) will encourage the involvement of everyone in the group. NGT prevents excessive influence by a few individuals by asking everyone to generate ideas anonymously. These ideas are then collected and written on easels or whiteboards. Next, the ideas are clarified in full group and each individual lists the ideas they think have high priority. Finally, the highest-priority ideas are selected from this shortened list.

The More You Know . . .

In some cases, you may find it effective to split project objectives into two different categories. The first category represents primary results and restrictions that will be directly addressed by the project. Designate these under the heading, "At the end of the project we will have . . ." The second category represents indirect benefits and less important restrictions. These can be designated under the heading, "Other project objectives are . . . "

It's possible that some project objectives absolutely must be met, while others can be satisfied to varying degrees. The absolute requirements are called *Must objectives.* These objectives should be mandatory, have a set limit that must be met, and be realistic to accomplish. Example 2.1 contains a Must objective: Office layouts must fit within allocated office area.

The remaining objectives can be classified as *Want objectives.* Although they may be important to accomplish during the project, they do not have an absolute minimum or maximum threshold that must be met. "Minimized barriers to information flows" in Example 2.1 is a Want objective. For more information on Must and Want objectives, see Decision Analysis on page 181.

Finally, you, your project team, and the customer will use project objectives to assess progress and evaluate performance. After the project has been completed, you'll ask, "How well did we meet each

BOX TOPIC 2.2

The Good, the Bad, and the . . .

Make sure no objective is repeated or contains more than one requirement and that all your objectives represent "why" you are doing this project rather than "how" you plan to do it. Some characteristics of good and poor objectives that you can use to audit your project objectives are listed below.

Good Objectives Are . . .	Poor Objectives Are . . .
Stated in terms of specific end results	Stated in terms of activities, deliverables, features, or processes
Each limited to a single important result	More than one objective in the statement
Clearly stated	Compound, too broad
Achievable in a stated time period	Never fully achievable in a stated time period
Related to the outcome of the project	Ambiguous in defining what is expected
Important to the success of the project	Not of real consequence
Precisely stated in terms of quantities, where possible	Too brief, indefinite, long, or complex
Definite measurement standards and methods	Theoretical, idealistic, or impractical
Formally documented	Verbalized only; assumed to be understood by everyone
A mix of short- and long-term objectives	Either all short- or long-term objectives
Unique	Duplicates or restatements of other objectives

On some occasions, a single objective may mean different things to different people. It's very important to express what you're trying to achieve when you write an objective so that it's clear to you and to others. There's a tendency to want to get away with a minimum number of words. Thus, people may abbreviate objectives into a few terse words and subsequently cause major communication difficulties. It's always worthwhile to ask, "Is (objective) understandable to someone other than myself?" or "What do I/we mean by (objective)?"

objective?" The answers will help you and your customer create a "report card" at the end of the project.

DEVELOP THE WORK BREAKDOWN STRUCTURE

Your project statement and objectives should communicate *what* you're doing and *why* you're doing the project, as well as the boundaries you'll recognize. The next activity, Develop Work Breakdown Structure (WBS), will communicate *how* you'll do it.

TIP

Several major deliverables may support a single project objective, or multiple project objectives may be supported by one major deliverable.

A WBS identifies the scope of all the work to be accomplished during the project and organizes it to show how all the pieces fit together. To create a WBS, follow these steps:

1. *Review the project statement and objectives.* The WBS organizes the work that's necessary to accomplish your project goals. It is the skeleton on which the whole project rests. The quality of the choices made in defining the organization of the work could mean the difference between a successful project implementation and a "death march." So it's important that when developing the WBS, you remember why you are doing the project in the first place.
2. *Create a list of major deliverables that represent the project's overall output.* To identify each major deliverable and accomplishment, ask:
   - What are the major components that must be produced to meet project objectives?
   - What are the major achievements that must be accomplished to meet project objectives?
   - What categories or groupings represent work that should (logically) be managed together?

Your answers to these questions will begin to identify major deliverables that will, in turn, provide the framework for the remainder of the WBS.

TIP

Should you record "Report written" or "Report" to describe writing a report? Both methods are acceptable, but the first better communicates the desired output (report), the mode (written versus printed or copied), and specific scope (written versus outlined, summarized, or delivered verbally).

3. *Separate each major deliverable into sub-deliverables.* This involves breaking down each major deliverable into its component parts. To help you separate, ask:
   - What needs to be done to produce this major deliverable?
   - If we were to watch this actually being done, what activities would we witness being completed?

Your answers will become sub-deliverables.

In addition, sometimes it will be useful for you to break down your sub-deliverables into sub-sub-deliverables.

A good rule of thumb: Stop breaking the work down when you've reached the point where primary responsibility can be assigned to one person or one group and a reasonable estimate can be made as to what kind and how many resources you'll need. This is the point where you'll feel comfortable handing the work to someone else, knowing that they'll understand what needs to be done.

The lowest level deliverable is called a *work package.* This is the level at which responsibility is assigned, resources are consumed, and work is completed. (For more information on separating and clarifying, see Situation Appraisal on page 176.)

PITFALL

Don't separate deliverables into too much detail! This will complicate the project and make it difficult to monitor during implementation. The level of detail in the WBS should represent the level of detail that will actually be managed by the project manager. Any more detail than necessary and the WBS becomes a blueprint for communication overload.

4. *Select a type of structure for your WBS.* A project structure is a way of organizing major deliverables that will make it easier to manage and communicate. Here are some common types of structures:
   - Product-based (major deliverables organized by tangible outputs).
   - Process-based (major deliverables organized by workflow).

How Do Your Work Packages Measure Up?

Review your work packages. Do they contain performance standards? Performance standards describe the expectations for the work; ensuring their integration into your work packages will clarify exactly what needs to be done. Performance standards can appear in the following forms:

- *Design specifications*—describe the work package output in terms of physical characteristics. For example, a work package to "dig a house foundation" may state it should be dug exactly five meters deep, 20 meters wide, and 30 meters long.
- *Performance specifications*—operational capabilities the work package must achieve. For example, a work package to "produce a racing engine crankshaft" could state that it must be capable of turning 15,000 revolutions per minute for four hours before failing.
- *Functional specifications*—similar to performance specifications, these describe the required end use. For example, a work package to "produce a computer training room" might say the room must accommodate up to 12 people for training in project management software. It doesn't specify type and quantity of computers, size of room, etc. This gives those responsible for the work package more latitude to find creative, less expensive, and/or better ways to meet the goal of software training for 12 people at a time.

Use the type of performance standard that best reflects the results you want to achieve. It's possible that more than one type of performance standard is needed to describe all aspects of a work package's desired output.

Record performance standards, assumptions you make, and further details about the work in a WBS dictionary. A WBS dictionary is a compilation of the details and history of the project. It will help ensure that work is well understood and can be resourced, planned, and implemented accurately. This will be especially helpful for tasks that are complex, new, or are likely to be handed off during the project. Software packages often allow for the creation of WBS dictionaries.

- Phase-based (major deliverables organized by stages).
- Resource-based (major deliverables organized by type of resource).

TIP

How do you know which work goes together to form a major deliverable? Group the work together according to these criteria—work that will be accomplished during the same time period, share similar resources, be tied to the same output, be funded in the same way, or be done in a particular way because of how the organization is set up.

Sometimes, the project work suggests an approach naturally; other times, you'll need to think about which approach will best help you manage and monitor the project. For example, most research and development project managers choose a phase-based approach for structuring project work. Because future work often depends on the result of current work or research, it makes sense to organize the work in phases like discovery, validation, prototyping, and so on.

At this point, you may consider breaking off a piece of the project and treating it separately as a subproject. For more information on subprojects, see Splitting Projects into Subprojects on page 50.

5. *Record the relationship between major deliverables and work packages.* Each deliverable should be equal to the sum of its work packages. In other words, completion of sub-deliverables should, by definition, complete a major deliverable. Look at major deliverable 1: Office Layouts in Example 2.2. It's broken down into three sub-deliverables (1.1 Relationship charts prepared, 1.2 Department block layouts drawn, and 1.3 Department detailed layouts drawn). As a result of completing these three sub-deliverables, Office Layouts is completed. Also notice that deliverable 1.1 is further broken down into two sub-sub-deliverables (1.1.1 Interviews conducted and 1.1.2 Relationship charts drawn).

TIP

It may be a good idea to include such work as planning the project, managing the project, conducting project meetings, and closing out the project in your WBS to get a better sense of the total scope of the project.

There are several tools you can choose from to depict this relationship. The two most common are the *indented outline* and the *tree diagram.* Example 2.2 depicts an indented outline. As you can see, the levels of work are indented, and numbering is shown as a 1, 1.1, 1.1.1 system. A tree diagram, on the

Example 2.2 Work Breakdown Structure—Indented Outline

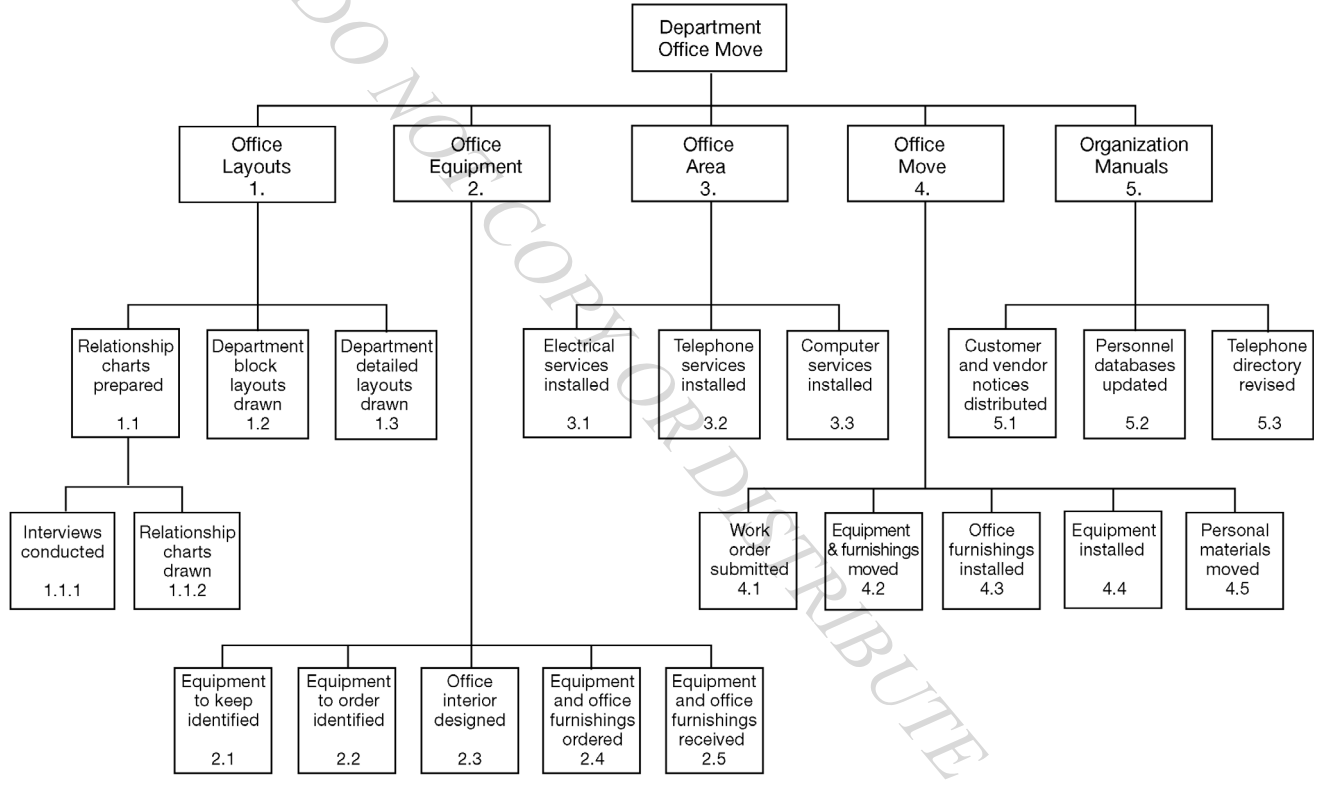
Project Statement

Move the Corporate Customer Services Department within three months at a cost not to exceed $170,000.

Work Breakdown Structure

1. Office Layouts
   - 1.1 Relationship charts prepared
     - 1.1.1 Interviews conducted
     - 1.1.2 Relationship charts drawn
   - 1.2 Department block layouts drawn
   - 1.3 Department detailed layouts drawn
2. Office Equipment
   - 2.1 Equipment to keep identified
   - 2.2 Equipment to order identified
   - 2.3 Office interior designed
   - 2.4 Equipment and office furnishings ordered
   - 2.5 Equipment and office furnishings received
3. Office Area
   - 3.1 Electrical services installed
   - 3.2 Telephone services installed
   - 3.3 Computer services installed
4. Office Move
   - 4.1 Work order submitted
   - 4.2 Equipment and office furnishings moved
   - 4.3 Office furnishings installed
   - 4.4 Equipment installed
   - 4.5 Personal materials moved
5. Organization Manuals
   - 5.1 Customer and vendor notices distributed
   - 5.2 Personnel databases updated
   - 5.3 Telephone directory revised

Example 2.3 Work Breakdown Structure—Tree Diagram



other hand, is found in Example 2.3. It shows the relationships between work packages and deliverables using lines and boxes.

6. *Review the WBS.* This activity should not be a mere glance at your outline or diagram. Rather, it should be a close examination to ensure that all project objectives are supported by the work described and all work packages support at least one objective. To review your WBS, ask:
   - What objective does this work package support? (If it doesn't support an objective, it doesn't belong in your WBS.)
   - Are all of the project objectives sufficiently supported by the work described? (If they are not, this may be an early sign you won't achieve all of your goals.)
   - Can all work packages be assigned resources and responsibility? (If not, then the work packages may be poorly worded, frivolous, or in need of further clarification or separation.)

Developing a WBS will help you and the project team determine how you'll accomplish the project objectives. It will also communicate to the project team how much and what kind of work will be expected on the project, and, to some extent, how that work will be managed and controlled. When you have the WBS in place, you and your project team will have the basis for establishing resource requirements, budgeting and pricing, assigning responsibility, sequencing and scheduling, and reporting for project monitoring.

Join Together

Consider involving the same groups of people (project team, stakeholders, experts, customers, key contributors) you included in discussions on project statement and objectives . . . with one exception. If possible, invite current and past project managers who have managed similar projects to help develop or review your WBS. Perhaps more than anyone else involved, they will help you identify omissions, areas for improvement, and potential problems and opportunities.

Keep in mind, however, that you should set expectations about the level and extent of each group's participation. As project manager, you

can choose to develop the WBS alone, develop it by involving others in decisions about structure and content, or assemble a group to develop the entire thing. Your choice should be driven by a need for commitment to the project's implementation, as well as availability of information. For more information on managing the involvement of others, see Involving People on page 149.

The More You Know . . .

It's possible that, in your organization, nothing like the project you're going to do has ever been done before. In fact, it's possible that nothing like it has ever been attempted. There are no previous project managers or internal experts to consult, and, consequently, you may find it difficult to anticipate the work required beyond a short time frame. What's more, the structure and type of future work may depend upon the outcome of work in the near term. If this is the case, consider using a technique called *moving window* (also known as *rolling wave*) to plan your project by phases. At agreed-upon time intervals, you and the project team will meet to flesh out the project plan, including more details as necessary to implement and control the next phase of the project.

IDENTIFY RESOURCE REQUIREMENTS

Once you've established what you are going to do (project statement), why you are going to do it (objectives), and how you're going to do it (WBS), you can identify what and how many resources are required to get it done.

Think of the WBS (which you developed in the last activity) as a series of project outputs—a collection of major deliverables that describe what work will be completed. If the WBS is the output, then *resource requirements* are the inputs—things that the project will consume in order to produce the outputs.

The approach to developing project resource requirements consists of identifying three elements for each work package:

1. Type of resources that will be required.
2. Amount of each type that will be needed.
3. Cost of the resources.

Identify which of the following *types* of resources you'll need to complete each work package—human, facilities, equipment, materials and supplies, and "special" resources:

TIP

Use project team members and contributors to brainstorm a list of all the resources you'll need to complete this project. Then identify which resources will be required for each work package.

- Human resources identifies specific professional and technical skills and the knowledge and experience the work package will require.
- Facilities refers to the specific type of location, space, or work area required (physical plant).
- Equipment represents the tools, machines, or systems needed (electrical or mechanical and reusable).
- Materials and supplies are the raw materials, purchased goods, parts, sub-assemblies, supplies, books, or documents required (consumables).
- Special resources refer to anything that might not be commonly available in your organization and that could require special effort to obtain. For example, if a compact disc manufacturer needed gold to complete a project, it might be considered a special resource since it's not something the organization uses regularly.

Not all of these resources will come from within your organization. If you need to explore outside vendors, it's important to know more about contracts. (See Contracts for Survival on page 51.)

Once you've identified the type of resources you'll need to complete each work package, you can determine the *amount* of each resource the work package will require. For example, look at work package 3.1 in Example 2.4 on pages 43–44. For knowledge and skills, the project team determined it would require two people with electrical skills working for three days for a total of 48 hours (based on the assumption that it would take one hour to hook up each workstation); and someone from facilities to oversee the work. For materials, it was determined that electrical wiring (cable and connectors) would be needed for 48 workstations.

Frequently Forgotten Resource Requirements

Have you ever left for a long business trip or vacation, only to be plagued by the feeling that you've forgotten something? Well, before embarking on your project management journey, make sure you include all resource requirements—even ones that project managers most often forget. Here are a few to consider:

- Cost-of-living adjustments, especially if the project has a lengthy time line
- Off-site differentials (labor and material costs may differ significantly in other locations)
- Equipment costs to perform or measure special operations
- License, permit, or certification costs
- Tariffs and duties
- Currency exchange
- Rush charges
- Overtime
- Documentation and reporting
- Planned prework

Now that you've determined the type and amount of each resource needed for each work package, you'll need to estimate the total *cost.* Do this by multiplying the cost per unit of a specific type of resource by the amount of units needed. For example, if a work package calls for someone with "database administration skills" to spend 18 person-days, and the cost is $400 per day, then the total cost for this resource would be $7,200 (18 × $400 = $7,200). Example 2.4 (pp. 43–44) displays the resource or skill needed, percentage of time allocated to each work package, and a cost estimate.

TIP

If you make assumptions when estimating the type, amount, or cost of resources, document them in the WBS dictionary and attempt to confirm them with experts or stakeholders.

When you estimate the time you'll need for human resources, use units that represent actual *time-on-task* rather than the overall duration of the task. For example, if you'll need a

Example 2.4 Resource Requirements

Work Packages	Knowledge/Skills				Facilities				Equipment				Notes
	Type	Amount	Unit Cost	Total Cost	Type	Amount	Unit Cost	Total Cost	Type	Amount	Unit Cost	Total Cost	
2.3 Office interior designed	Interior design skills	1×4 days = 32 hrs	$150 per hr	$4,800									Assumes designers will want to tour site
	Facilities management skills	1×2 days = 16 hrs	$0	$0									Assumes 3 department mgrs.
	Department knowledge	3×¼ day = 6 hrs	$0	$0									
	Project management skills	1×¼ day = 2 hrs	$0	$0									
	Engineering skills	1×¼ day = 2 hrs	$0	$0									
2.4 Equipment and office furnishings ordered	Purchasing skills	1×½ day = 4 hrs	$0	$0					Workstations	12	N/A	$70,000	Assumes 12 new workstations.
	Facilities management skills	1×¼ day = 2 hrs	$0	$0									
2.5 Equipment and office furnishings received	Receiving/storing skills	1×1 day = 8 hrs	$0	$0									
	Facilities management skills	1×¼ day = 2 hrs	$0	$0									
3.1 Electrical services installed	Electrical skills	2×3 days = 48 hrs	$65 per hr	$3,120									
	Facilities management skills	1×½ day = 4 hrs	$0	$0									
Totals				$7,920				$0				$70,000	

(continued)

Example 2.4 *Continued*

Work Packages	Materials				Special Resources					Notes
	Type	Amount	Unit Cost	Total Cost	Type	Amount	Unit Cost	Total Cost	$	
2.3 Office interior designed					Travel/ Entertainment			$250	$ 5,050	Assumes designers will want to tour site. Assumes 3 department managers.
2.4 Equipment and office furnishings ordered	Purchase orders	N/A	N/A	$0					$70,000	Assumes 12 new workstations. $70,000 is a discounted price.
2.5 Equipment and office furnishings received										
3.1 Electrical services installed	Electrical wiring	N/A	N/A	$6,000					$ 9,120	Assumes electrical wiring service for 48 work stations and 1 work station per hour to wire. Assumes 2 electricians Assumes cabling runs and connections for 48 workstations.
Totals				$6,000				$250	$84,170	

The Guess Work in Estimating

Identifying resource requirements requires you to estimate how much of those resources you will need. The three generally accepted estimating methods for project management are:

1. *Analogous*—You establish a total cost based on the typical cost of similar projects and then assign a percentage of the costs across the major deliverables. This estimate is developed to test the available budget.
2. *Detailed*—You establish the total cost by adding the cost of all the work packages.
3. *Parametric*—You use accepted norms for incremental pricing to obtain the estimate. For example, it will cost 20¢ per square foot to carpet your office.

There are also three different types of estimates you can produce. The type you choose should depend first on how rigorous you need to be to satisfy project stakeholders and then on how rigorous you need to be for planning purposes.

1. *Order of Magnitude*—Primarily used for determining project feasibility (accurate from –25% to +75%). This is calculated at the major deliverable level.
2. *Budget*—Relies on previous project data and benchmarking, and is used for general planning and budgeting (accurate from –10% to +25%). Budgets are calculated at the sub-deliverable level.
3. *Definitive*—Based on the detailed work plans and resource charts, and used to manage project performance (accurate from –5% to +10%). A definitive estimate is calculated at the work package level.

technical writer for four hours a day, two days a week over the course of three weeks, the total time will be 24 hours ($4 \times 2 \times 3 = 24$), not three weeks.

To complete your cost estimate, total the resource costs for each work package, then total the resource costs for each major deliverable. Finally, total all of the major deliverables to determine overall project cost.

TIP

You need to account for a resource's time on your project even if your organization does not account for their internal billing rate. This will help with scheduling from a limited pool of resources that is required to support several projects.

Alternatively, it may be important to total resource costs by type. For example, you may want to separate total equipment costs if they represent a cash outlay as compared to human resources that will be accounted for only as an internal billing charge to the project.

Identifying resource requirements will help you assess the total effort required to complete the project—giving you, as well as management and other project stakeholders, an understanding of the true cost of the project. In addition, outlining resource requirements at the beginning of a project will provide you with a basis for controlling project costs and monitoring resource use during implementation. It is the starting point for establishing the *code of accounts* or *chart of accounts.* These terms refer to the numbering system that will identify and track cost for each work package by type of expense, such as labor, materials, equipment, and so on. Your organization's finance or accounting department may have a chart of accounts in place that apply here.

Join Together

Once again, you should rely on your project team and experienced project managers for input. However, also include the human resources themselves as well as their managers, since they usually have the best estimates as to how much time and effort it will take to complete their piece of the project. Including your resources will help you gain their commitment to the project. Involving the managers will enhance their willingness to release the resources to your project.

In addition, include experts who can provide initial estimates and validate estimates based on experience. Historical documents and commercial cost-estimating databases can also be helpful, if you have access to them.

It may also be useful to divide identifying resource requirements into two rounds. In the first round, you'll calculate an initial estimate with the help of others. In the second round, you'll review the initial

estimate with the same resources, as well as with others who can spot inaccuracies, oversights, or shortcuts.

The More You Know . . .

You may want to do a cost/benefit analysis before implementing your project. Once you've established the overall cost of the project, you'll be able to compare it with the value described in the project statement and objectives. This will confirm whether you should continue defining and planning the project, whether adjustments need to be made, or whether the project should be completely rethought, delayed, or abandoned.

If adjustments need to be made at the work package level, examine the work packages and ask:

- How does this work package help us reach our objectives?
- Can we eliminate this work package and still meet the objectives?
- Is the cost for this work package greater than the value it delivers?
- Does this work package create more value, functionality, or reliability than is needed?
- Is there an alternative way to accomplish or complete this work package so that it has a better benefit-for-cost ratio?

TIP

You also need to understand the burden rates for work groups and departments. Many salaried organizations can only come to terms with human resource capacity constraints when they see the financial implications of adding more projects to their portfolio.

There's also the possibility that you'll choose between several alternatives when selecting a resource. If this is the case, there are a number of variables to consider, including things like:

- Geographic locations
- Transportation options
- Local/federal laws and regulations
- Organizational policies and procedures
- Industry best practices

- Political dynamics
- Availability of resources
- Time needed to acquire new capabilities

For more information on making a decision, see page 181 for a description of Decision Analysis.

Dealing with uncertainty is almost unavoidable when it comes to estimating the amount and cost of resources. Therefore, many project managers tend to *overestimate* to ensure that they don't "blow the budget." After all, it's much easier to explain why you performed under the budget than why you overshot your mark.

Common methods for preparing for the unexpected include contingency planning, backup resources, and reserve funds. All three (and there are others) basically refer to built-in space to accommodate the unexpected. Some project managers increase the amount of particular resources needed; others increase the duration of specific tasks; and still others use multipliers to pad their estimates. In some organizations, a contingency fund is established in case resource estimates prove inaccurate, significant changes in scope occur, or unanticipated threats alter the project plan. However, a project manager must present clear, documented reasons for tapping reserve funds, and, often, approval must come from management.

PITFALL

Don't overestimate just to avoid rigorous estimating. Overestimating work package requirements without precise calculation can result in an inaccurate overall estimate. This could threaten the approval of the project, or occupy resources that could be better spent elsewhere.

The best way to handle uncertainty isn't to randomly pad your resource requirements. Rather, it's to examine the likelihood that an estimate will be inaccurate, the potential magnitude of the difference, and what the impact will be on the overall project (and organization) if it's incorrect. For example, estimating resources and costs associated with work packages that have not been done before will probably have a high likelihood of being inaccurate. In this case, you may want to overestimate. For more information on planning for what could go wrong, see Protect and Enhance the Plan on page 82.

ADDITIONAL DEFINITION TOPICS

Choose to Win: Selecting a Project Manager

Organizations around the world embrace project management as the way they accomplish work. Not surprisingly, the role of the project manager has become increasingly critical, and the demands and responsibilities of the job have grown.

As a project manager, you're sensitive to the needs of the project, and smart enough to sell it to senior management and other stakeholders. You work effectively with theoretical-minded scientists and researchers while still staying within the budget. And you balance the differing schedules and workstyles of creative individuals like graphic designers and software programmers with the need to meet deadlines. Sound a bit like a superhero?

Selecting a project manager demands a careful, rational process. Choosing the right project manager might mean the difference between a successful project and a failure.

Each project is unique and will require specific selection criteria. However, there are several generic criteria that will get you started. In general, a project manager should have:

- Management skills for team building, negotiating, delegating responsibility, managing performance, managing the involvement of others, and conducting project communication
- Technical knowledge and skills relevant to the project
- Project management skills
- Problem-solving and decision-making skills
- Commitment to the project's success
- Support from their manager
- Time to devote to the project
- Ability to develop a working relationship with team members and other stakeholders

For more information on establishing objectives to help you decide on which project manager to pick, see Decision Analysis on page 181.

Splitting Projects into Subprojects

Most project managers prefer to maintain control over all aspects of their projects; relinquishing a major deliverable or two can carry a negative connotation because it implies that they can't handle the work. Not true. In fact, determining whether part of your project should be managed separately is often necessary if you want to complete the overall project on time and within budget. Subprojects can be done within an organization, or completely delegated to an outside vendor or contractor.

Complex or lengthy projects often require subprojects to group or manage activities that are similar in nature, share resources, share funding, or have constraints that require they be done together.

Here's a list of questions to help you decide whether to split your project into two or more subprojects:

- Is the overall project too large or complex for a single person to manage effectively? If so, consider separating it.
- Does work for one part of the project require specialized knowledge? Specialized or technical work may require a subproject manager with skills or knowledge in that area.
- Should resources be managed differently for parts of the project? It's often best to manage work together if it requires the same type of resources or special cost accounting.
- Is someone needed to sponsor a part of the project? Grouping work together that shares a need for the same special influence can help expedite the process.

Once you've sliced off a subproject, treat it like a mini-project. Assign a separate subproject manager; develop a statement, objectives, and WBS; review the resource requirements; then, follow the remaining steps and activities in this book. Remember to keep the project objectives for the subproject consistent with the overall

project objectives. It may require additional or different monitoring, and the subproject manager may choose to add more detail to the WBS, responsibility assignments, and schedule.

Contracts for Survival

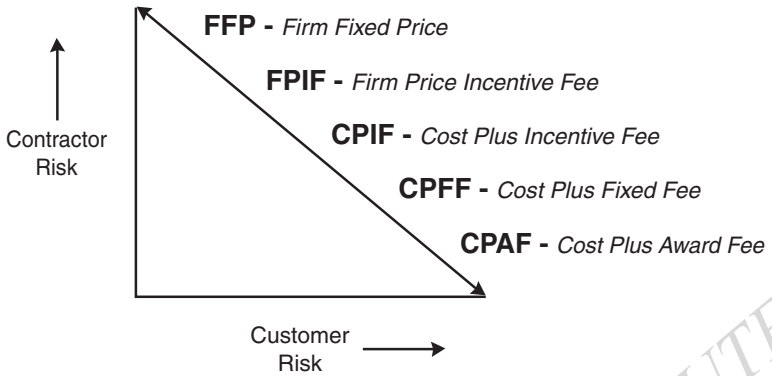
If you decide to use an outside vendor to provide a resource or handle a work package or subproject, first study the types of contracts available:

- *Firm fixed price* (FFP): The vendor will only receive the agreed price, regardless of any unanticipated cost or schedule overruns.
- *Firm price incentive fee* (FPIF): The vendor receives the agreed price plus a bonus for on-time or early completion.
- *Cost plus incentive fee* (CPIF): The vendor receives actual costs to provide the goods or services plus a bonus for on-time or early completion.
- *Cost plus fixed fee* (CPFF): The vendor receives actual costs plus a guaranteed fee, even if the project is not completed.
- *Cost plus award fee* (CPAF): The vendor receives actual costs plus an award based on performance against some quality indicator(s).

Your choice will depend on the goods or services being provided, as well as the financial risk involved (for the vendor as well as your organization). Obviously, firm fixed price (FFP) contracts are high-risk for the vendor and low-risk for the customer. Conversely, cost plus award fee (CPAF) contracts place most of the potential risk with the customer and very little with the vendor. The others represent risk ratios somewhere between those extremes. The type of contract chosen should reflect several things, including:

- The degree of difficulty in providing the goods or services.
- Whether it involves hazardous materials or methods.
- Whether there will be future use for the goods or services.
- Whether the deliverable is well defined and unlikely to change.

Contractor-Customer Risk



Select the contract that represents risk that is acceptable to both the vendor and your organization. Your organization's legal, contracting, and purchasing departments may have policies and procedures in place that apply here.

TIP

In some countries, the government or other agencies provide incentives for hiring nontraditional subcontractors. Project managers should examine their project plans for opportunities where such subcontractors could be best utilized.

Assessing the Financials

Cost is often a critical factor in projects. The money spent should be considered as an investment, and a reasonable return should be expected. The worth of the investment is often the deciding factor for whether a project gets done or which among several possible projects deserves allocation of limited resources. Organizations typically use several methods to assess a project's financial soundness.

Payout time is one method of evaluating the investment. This method compares all the project expenses to the expected net income by time period (e.g., by month or year), and finds the point when the investment will be repaid. Capital is not included in the expenses because it does not represent worth that leaves the organization. Cash spent on capital is simply converted to physical and durable goods retained within the organization. Project income is in

the form of revenue or savings produced from the project. Organizations often have set standards for payout time. For example, a policy may state that no project will be approved with a projected payout time of more than one year.

Return on investment (ROI) is the ratio of annual profit to the investment in the project. The average annual profit produced by the income is divided by the total project investment. Multiplying this number by 100 represents the ratio as a percentage. To calculate ROI, capital is included in the project expenses, since it represents money that could be invested elsewhere. Any depreciation expected on that capital must also be subtracted from the annual profit. Many organizations use ROI to compare projects competing for the same investment or to test against a set minimum return that any project must outperform.

Net present value (NPV) calculates how much value a project will produce beyond an expected return, should the investment be retained in another minimally acceptable form. For example, an organization may have a choice between keeping cash invested in a certificate of deposit returning 10 percent, or putting it into a project. NPV calculates how much more cash the project will return than if the cash were kept in the certificate of deposit. This is calculated using the following formula:

$$\text{NPV} = \frac{\text{Year 1 income}}{(1 + \text{Accepted return})^1} + \frac{\text{Year } n \text{ income}}{(1 + \text{Accepted return})^n} - \text{Investment}$$

Internal rate of return (IRR) considers the time value of money. In other words, it factors in not only the return but also how quickly it will be realized. It shows this as a discount rate that makes the expected returns equal to the current investment. This rate can be compared to the rates earned by investing the money in other projects or investments. If the project requires borrowing, an organization will usually insist that it must earn an IRR that is at least several percentage points higher than the cost of borrowing to compensate for the risk, time, and trouble associated with the project. For example,

consider a project costing $7,500 and expected to return $2,000 per year for five years, or $10,000 total. The IRR calculated for the project would be 10 percent. If the cost of borrowing is less than 10 percent, the project may be justified. If the cost of borrowing is 10 percent or greater, the project will break even at best. The easiest way to calculate IRR is to use a financial calculator or present value tables. If the income is uneven each year, IRR can be calculated by trial and error, using different rates in the following formula, until the rate equals the expected return.

$$\text{Investment} = \frac{\text{Year 1 income}}{(1 + \text{RR})^1} + \frac{\text{Year } n \text{ income}}{(1 + \text{RR})^n}$$

Definition Summary

Definition serves as the precursor to Planning and Implementation. It's here that the scope and reasons for completing the project become clear to the project team, project stakeholders, and contributors. It's the time when you begin to gain commitment from these groups. It's also the time when the organization decides to link its resources to the objectives it's trying to achieve.

In *The Modern Theme*, José Ortega y Gasset wrote "To define is to exclude and negate" (translated from Spanish by James Cleugh, W. W. Norton, New York, 1933, p. 99). Although he intended a negative connotation, you might agree that his words apply to the work done during project definition. To define your project is to specify its purpose and scope, excluding everything else. Or, as the anonymous sculptor said, "When I sculpt a statue of an elephant, I take a block of stone and chip away everything that doesn't look like an elephant."