Project Management and Event Planning for Office Administrators

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Contents

Acknowledgements

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The overall changes in content from the adapted book can be found below. Specific section attributions can be found at the bottom of each section, with a note about modifications if applicable.

Chapter in this Book	Modifications from Adapted Book
Chapter 1	Chapter 1 and Chapter 3 were combined, and 1.6 and 3.7 were removed.
Chapter 2	Chapters 4 and 4.7 were removed. Chapter 16 from NSCC Project Management was added, and the content was split into three sections.
Chapter 3	Chapters 5, 6 and 8 were combed. Sections 5.7, 6.7 and 8.6 were removed.
Chapter 4	Chapter 10 was added, and section 10.7 was removed. Chapter 17 from NSCC Project Management was added.
Chapter 5	Chapters 11 and 11.7 were removed.
Chapter 6	Chapter 9 removed section 9.7, added chapter 11 from Introduction to Tourism and Hospitality in BC and section 2.1 from Canadian Health and Safety Workplace Fundamentals

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About this Book

As Office Administrators, we are often looked to as the folks who “get stuff done.” Many times, we are tasked with jobs and projects that are new to us, and we have the opportunity to design the path that our teams will take as they work through those projects.

This book is a compilation and adaptation of existing Project Management and Event Planning open education resources. The goal is to focus on topics that are most relevant for Office Administrators that will help us design those paths. At the moment, the chapters are primarily about Project Management. The sections about Event Planning will grow as resources are created and added.

We welcome feedback about ways the book could be improved. Please reach out if you have ideas for improvement.

Feedback

Please share your adoption, and any feedback you have about the book with us at oer@fanshawec.ca

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CHAPTER 1 - INTRODUCTION TO PROJECT MANAGEMENT & THE PROJECT LIFECYCLE

Chapter Overview

1.1. Chapter Introduction

Learning Objectives

By the end of this chapter, you should be able to:

1. Define the characteristics of a project.
2. Compare the difference between traditional and Agile project management.
3. Describe how program management differs from project management.
4. Explain the three broad categories of projects.
5. Explain the four phases of project management.
6. Describe the documentation produced during the project initiation.
7. Identify the importance and the purpose of project planning.

There is no greater example of the art and science of project management (PM) than those demonstrated in building the Pyramids of Egypt. Since then, builders and engineers have applied specific processes systematically, and these have evolved into PM. Today, in every field of work, PM is an essential practice to achieve project success. The objective, in general, is to establish and deliver the customer objectives in an organized and detailed manner. Whether the business is in production, construction, or service delivery, planning and carrying out a project requires clearly defined processes.

While the general management function may include many tasks, PM is specifically oriented toward processes and requires a specific set of tools and skills. When PM is performed correctly, organizations gain greatly. PM can reduce risk and improve the likelihood of success. It approaches tasks in an organized, detailed, and accountable way. Even when organizations have limited resources and a small chance of success, PM experts can help lead through recessions and economic uncertainty and ensure future strategic goals are met. Therefore, performing PM requires dedicated individuals with good discipline who understand the processes and are able to follow through to completion. Good project managers keep the project on track and ensure the alignment of project objectives within the strategic objectives of the organization.

The starting point in discussing how projects should be properly managed is first to understand what a project is and, just as importantly, what it is not.

1.2. Project Management (PM) Definition

Project

A **project** has distinctive attributes that distinguish it from ongoing work or business operations. Specifically, projects are temporary in nature. Therefore, they are not an everyday business process, but they are unique and have definitive start dates and end dates. This characteristic is important because a large part of the project effort is dedicated to ensuring that the project is completed at the appointed time. To do this, schedules are created showing when tasks should begin and end. Projects can last minutes, hours, days, weeks, months, or years.

Projects exist to bring about a product or service that has not existed before. In this sense, a project is unique. Unique means that this is new; it has never been done before. Maybe it's been done in a very similar fashion before, but never exactly in this way. For example, although the Ford Motor Company is in the business of designing and assembling many kinds of vehicles, each model that Ford designs and produces can be considered a unique project. The models differ from each other in their features and are marketed to people with various needs. An SUV serves a different purpose and clientele than a luxury car. The design and marketing of these two models are unique projects. However, the actual assembly of the cars is considered an operation (i.e., a repetitive process that is followed for most makes and models).

Program

When a group of projects is arranged towards achieving a certain goal this is said to be a **program**. It is a collection of small projects to deliver or achieve certain higher goals. The simplest example of a program is the degree program in a school or college, where multiple courses correspond to the projects. In this, a program will be completed when all projects are completed and the certificate/degree is awarded.

Operation

In contrast with projects, **operations** are ongoing and repetitive. They involve work that is continuous without an ending date and with the same processes repeated to produce the same results. The purpose of operations is to keep the organization functioning, while the purpose of a project is to meet its goals and objectives. Therefore, operations are ongoing, while projects are unique and temporary.

A project is completed when its goals and objectives are accomplished. It is these goals that drive the project and all the planning and implementation efforts undertaken to achieve them. Sometimes, projects end when it is determined that the goals and objectives cannot be accomplished or when the product or service of the project is no longer needed, and the project is cancelled.

Definition of a Project

There are many written definitions of a project. All of them contain the key elements described above. However, for those looking for a formal definition of a project, the Project Management Institute (PMI) defines a project as a temporary endeavour undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project's objectives

have been achieved when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists.

The term "project" is used in several ways in popular culture, from describing everyday tasks (planting a garden, hanging a picture, running errands) to large-scale enterprises (building a house, constructing a new highway). However, when professional project managers talk about projects, they use a narrower definition. Let's start out with the six defining characteristics of a project. Just about every book, organization, or standards body in the project management field agrees that a project:

- is a temporary endeavour with a defined start and end.
- has a specific objective.
- has customers or stakeholders.
- has constraints, such as time, cost, and scope.
- has measures for success.
- includes some amount of uncertainty.

Watch the video *What is a Project* for more information on how these six aspects help define what a project is and is not.

Operations vs. Projects

Projects are different from ongoing operations, even though some techniques (such as network diagramming) overlap. Project management addresses temporary endeavours with a start and end date, while operations management focuses on improving ongoing operations. For example, constructing a new factory is a project, while producing bicycle tires in that factory is an operation.

1.3. Types of Projects

There are three broad categories of projects to consider: Strategic Projects, Operational Projects, and Compliance Projects (Figure 1.1).

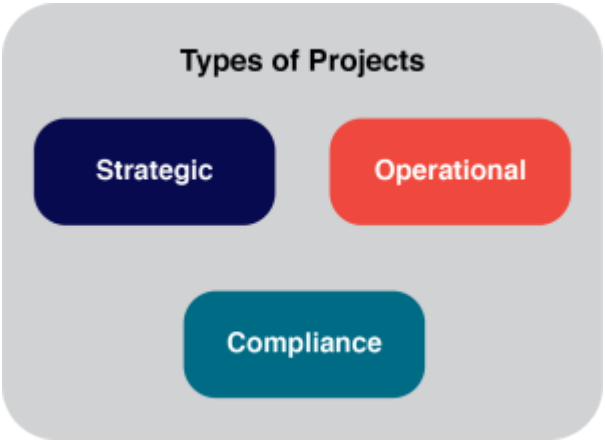

Figure 1.1: Three broad categories of projects

- **Strategic** Projects involve creating something new and innovative. A new product, a new service, a new retail location, a new branch or division, or even a new factory might be a strategic project because it will allow an organization to gain a strategic advantage over its competitors.
- **Operational** Projects improve current operations. These projects may not produce radical improvements, but they will reduce costs, get work done more efficiently, or produce a higher-quality product.
- **Compliance** Projects must be done in order to comply with an industry or governmental regulation or standard. Often there is no choice about whether to implement a project to meet a regulation, but there may be several project options to consider, any of which would result in meeting compliance requirements.

Traditional Project Management

While project management can be traced back to the building of the Great Pyramids in Egypt, it was really in the post-WW2 industrial boom of the 1950s that project managers started to develop the tools and techniques used in modern project management. These tools were used to complete large industrial and military projects, where the scope of work (what we need to accomplish in a project) was well defined. For example, the scope of what we have to do can be planned out well when we are constructing an apartment building, making a nuclear submarine missile, or building an oil refinery.

These traditional techniques have been elaborated and standardized by organizations such as the Project Management Institute (PMI) in the US, The International Project Management Association (headquartered in Switzerland), and AXELOS (the organization behind the PRINCE2 certification used in Great Britain). These traditional techniques were also adapted to software development. Techniques such as **waterfall** (where phases are sequential) and **function point analysis** (a set of rules to measure functionality to users) were advanced as effective ways to manage software development projects. However, as the world of software development changed—from large, time-consuming projects that were loaded on mainframe computers to fast-moving, fast-changing, internet-based applications many programmers found waterfall and similar methods to be limiting. These techniques lacked flexibility and were inadequate to deal with a rapidly changing, competitive landscape. As a result, a "revolution" of sorts was mounted, and out of that revolution came several so-called Agile project management methods.

Agile Project Management

Agile is a broad term for project management techniques that are **iterative** in nature. Rather than trying to develop all aspects of a project or software application and then presenting that result to the customer after a

long development cycle (6 to 24 months), Agile techniques use short development cycles in which features of high value are developed first, and a working product/software can be reviewed and tested at the end of the cycle (20-40 days).

1.4. Aspects of Project Management

The Science of Project Management

Project management has been around for centuries, if not millennia. From the building of the pyramids to the construction of the great buildings of 19th century London, people have developed ways to break down large projects into smaller, more manageable chunks, schedule the work, and obtain the materials needed for the projects. During that time, many tools were developed to manage projects. However, it was not until the large, highly complex defence projects undertaken by the United States during the 1950s that a push for a more scientific and data-driven management approach to projects was driven, which was the beginning of the science of modern-day project management.

Project Management Institute

The Project Management Institute (PMI) started in 1969 as an effort to share best practices, and today, it is a non-profit organization with over 500,000 members. PMI has chapters throughout the world, and each offers additional benefits in the form of professional development and networking opportunities.

Project Management Body of Knowledge

PMI has codified the standards for project management in the Project Management Body of Knowledge (PMBOK) guide. The PMBOK is best used as a reference guide; it is not recommended for cover-to-cover reading. The PMBOK Guide has been recognized as a Standard by the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE).

The PMBOK guide is organized into ten knowledge domains:

1. Project Integration Management
2. Project Scope Management
3. Project Time Management
4. Project Cost Management
5. Project Quality Management
6. Project Human Resource Management
7. Project Communications Management
8. Project Risk Management
9. Project Procurement Management
10. Project Stakeholder Management

Project Constraints

Managing a project includes identifying your project's requirements and writing down what everyone needs from the project. What are the objectives for your project? When everyone understands the goal, it's much

easier to keep them all on the right path. Make sure you set mutually agreed-upon goals to avoid team conflicts later on. Understanding and addressing the needs of everyone affected by the project means the end result of your project is far more likely to satisfy your stakeholders. Last but not least, as project manager, you will also be balancing the many competing project constraints.

On any project, you will have a number of project constraints that are competing for your attention. They are cost, scope, quality, risk, resources, and time.

- **Scope** is what the project is trying to achieve. It entails all the work involved in delivering the project outcomes and the processes used to produce them. It is the reason for and the purpose of the project.
- **Time/Schedule** is defined as the time to complete the project. Time is often the most frequent project oversight in developing projects. This is reflected in missed deadlines and incomplete deliverables. Proper control of the schedule requires the careful identification of tasks to be performed and accurate estimations of their durations, the sequence in which they are going to be done, and how people and other resources are to be allocated. Any schedule should take into account vacations and holidays.
- **Cost** is the budget approved for the project including all necessary expenses needed to deliver the project. Within organizations, project managers have to balance between not running out of money and not underspending because many projects receive funds or grants that have contract clauses with a "use it or lose it" approach to project funds. Poorly executed budget plans can result in a last-minute rush to spend the allocated funds. For virtually all projects, cost is ultimately a limiting constraint; few projects can go over budget without eventually requiring a corrective action.
- **Quality** is a combination of the standards and criteria to which the project's products must be delivered for them to perform effectively. The product must perform to provide the functionality expected, solve the identified problem, and deliver the benefit and value expected. It must also meet other performance requirements, or service levels, such as availability, reliability, and maintainability, and have acceptable finish and polish. Quality on a project is controlled through **quality assurance (QA)**, which is the process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Project Priority

You may have heard of the term "**triple constraint**," which traditionally consisted of only time, cost, and scope. These are the primary competing project constraints that you have to be most aware of. The triple constraint is illustrated in the form of a triangle to visualize the project work and see the relationship between the scope/quality, schedule/time, and cost/resource (Figure 1.2).

Your project may have additional constraints that you must face, and as the project manager, you have to balance the needs of these constraints against the needs of the stakeholders and your project goals. For instance, if your sponsor wants to add functionality to the original scope, you will very likely need more money to finish the project. On the other hand, if they cut the budget, you will have to reduce the quality of your scope.

Project constraints should be defined by certain criteria such as acceptance, enhanced, and/or constrained. Each of these criteria represents a degree of priority to the project and hence assigning the resources. Such constraints are necessary to establish project priorities before the project begins. To explain this, consider a project to develop a vaccine during a pandemic time; the cost of such a project would not be of concern since the vaccine is needed, and therefore, the cost is less of a priority and will be acceptable. Meanwhile, the project scope in achieving a vaccine with high efficacy is more priority than cost, and hence, the priority of the scope is

constrained. The priority of time, in this case, can be enhanced, allowing for the limited time extension necessary to fulfill the scope. Therefore, for such a project, we would say the scope is constrained, the time is enhanced, and the cost is accepted.

Further, if you don't get the appropriate resources to work on your project tasks, you will have to extend your schedule because the resources you have take much longer to finish the work.

In summary, the constraints are all dependent on each other. Think of all of these constraints as the classic carnival game of Whac-a-mole. Each time you try to push one mole back in the hole, another one pops out. The best advice is to rely on your project team to keep these moles in place.

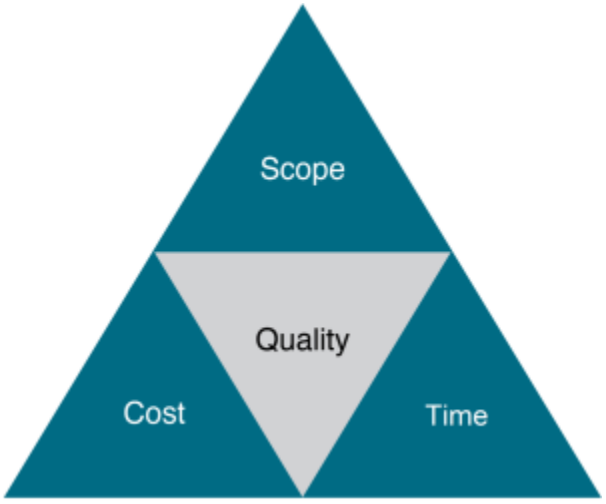

Figure 1.2: "The triad constraints" by John M. Kennedy T., CC BY-SA 3.0, adapted by Fanshawe College, CC BY-SA 3.0.

In this triangle, each side represents one of the constraints (or related constraints) wherein any changes to any one side cause a change in the other side. The best projects have a perfectly balanced triangle. Maintaining this balance is difficult because projects are prone to change. For example, if scope increases, cost and time may increase disproportionately. Alternatively, if the amount of money you have for your project decreases, you may be able to do as much, but your time may increase.

1.5. Life Cycle

The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has beginning and middle periods, during which activities move the project towards completion and an ending that is either successful or unsuccessful. A standard project typically has the following four major phases (each with its own agenda of tasks and issues): **initiation, planning, implementation, and closure**. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project's "**life cycle**."

A traditional project will go through different (overlapped) phases, while the monitoring process takes place continuously from the initiation phase to the closing phase. Monitoring her can be considered as a floating process required to ensure the alignment of the project processes with the project scope. During the life cycle, the execution phase will require the most effort from the project team and hence can be seen as the most productive phase (Figure 1.4).

Initiation Phase

During the first of these phases, the initiation phase, the project objective or need is identified; this can be a business problem or opportunity. An appropriate response to the need is documented in a business case with recommended solution options. A feasibility study is conducted to investigate whether each option addresses the project objective, and a final recommended solution is determined. Issues of feasibility ("Can we do the project?") and justification ("Should we do the project?") are addressed.

Once the recommended solution is approved, a project is initiated to deliver the approved solution, and a project manager is appointed. Thereafter, the major deliverables and the participating work groups are identified, and the project team begins to take shape. Approval is then sought by the project manager to move on to the detailed planning phase.

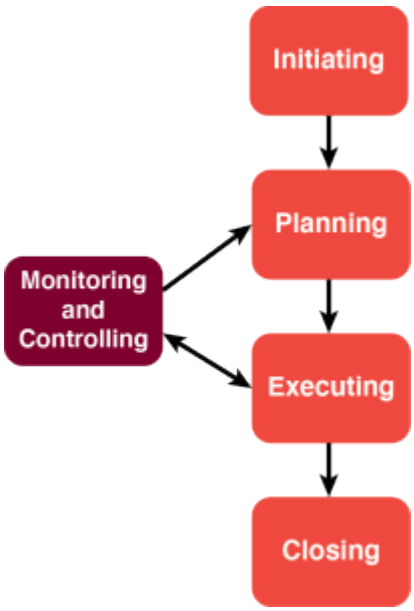

Figure 1.3: "Project management phases", CC-BY-SA 3.0.

Planning Phase

The next phase, the planning phase, is where the project solution is further developed in as much detail as possible, and the steps necessary to meet the project's objective are planned. In this step, the team identifies all of the work to be done. The project's tasks and resource requirements are identified, along with the strategy for producing them. This is also referred to as "**scope management**." A project plan is created outlining the activities, tasks, dependencies, and timeframes. The project manager coordinates the preparation of a project budget by providing cost estimates for the labour, equipment, and materials costs. The budget is used to monitor and control cost expenditures during project implementation.

Once the project team has identified the work, prepared the schedule, and estimated the costs, the three fundamental components of the planning process are complete. This is an excellent time to identify and try to deal with anything that might pose a threat to the successful completion of the project. This is called **risk management**. In risk management, "high-threat" potential problems are identified along with the action that is to be taken on each high-threat potential problem, either to reduce the probability that the problem will

occur or to reduce the impact on the project if it does occur. This is also a good time to identify all project stakeholders and establish a communication plan describing the information needed and the delivery method to be used to keep the stakeholders informed.

Finally, you will want to document a quality plan, providing quality targets, assurance, and control measures, along with an acceptance plan, listing the criteria to be met to gain customer acceptance. At this point, the project would have been planned in detail and is ready to be executed.

Implementation (Execution) Phase

During the third phase, the implementation phase, the project plan is put into motion, and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored, and appropriate adjustments are made and recorded as variances from the original plan. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed. The first course of action should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

Status reports should always emphasize the anticipated endpoint in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

Closing Phase

During the final closure or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn't. Through this type of analysis, the wisdom of experience is transferred back to the project organization, which will help future project teams.

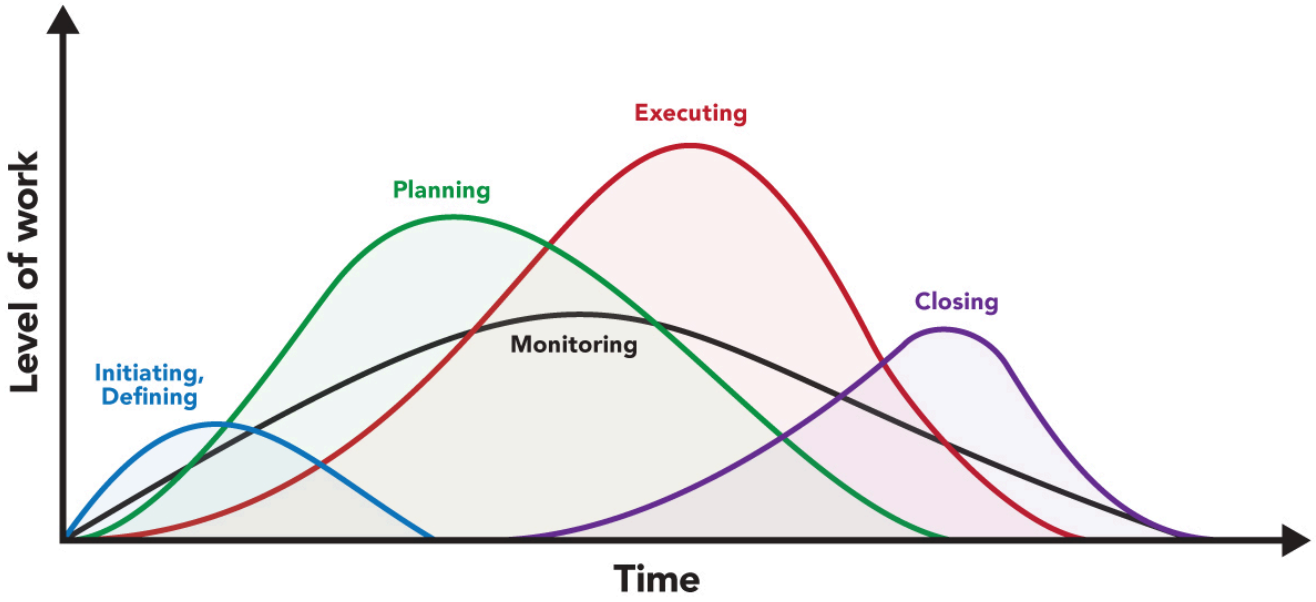

Figure 1.4: Illustration of work activity-time graph for a typical project life cycle.

1.6. Initiation

Project management has a dual nature; it is both a series of distinct phases with a clear beginning and end and a continuous, circular process in which each end leads to a new beginning. Throughout a project, a successful project manager strives to anticipate changing conditions rather than simply responding to them as they arise.

Let's start with the more traditional view, which describes project management as a series of sequential phases, with project initiation coming right after project selection. You can think of these phases, shown in Figure 1.5, as the particle nature of project management.

However, while project initiation marks the official beginning of a project, doing it well also requires looking past the making stage to the entire life cycle of the project's end result. You can think of this as the wave nature of project management. As illustrated in Figure 1.5, the making stage, in which a project is initiated and executed, is one part of the larger cycle that includes the operating/using/changing stage, in which the customer makes use of the project. Finally, the demolishing stage is when the project is retired so it can be replaced by something new and better.

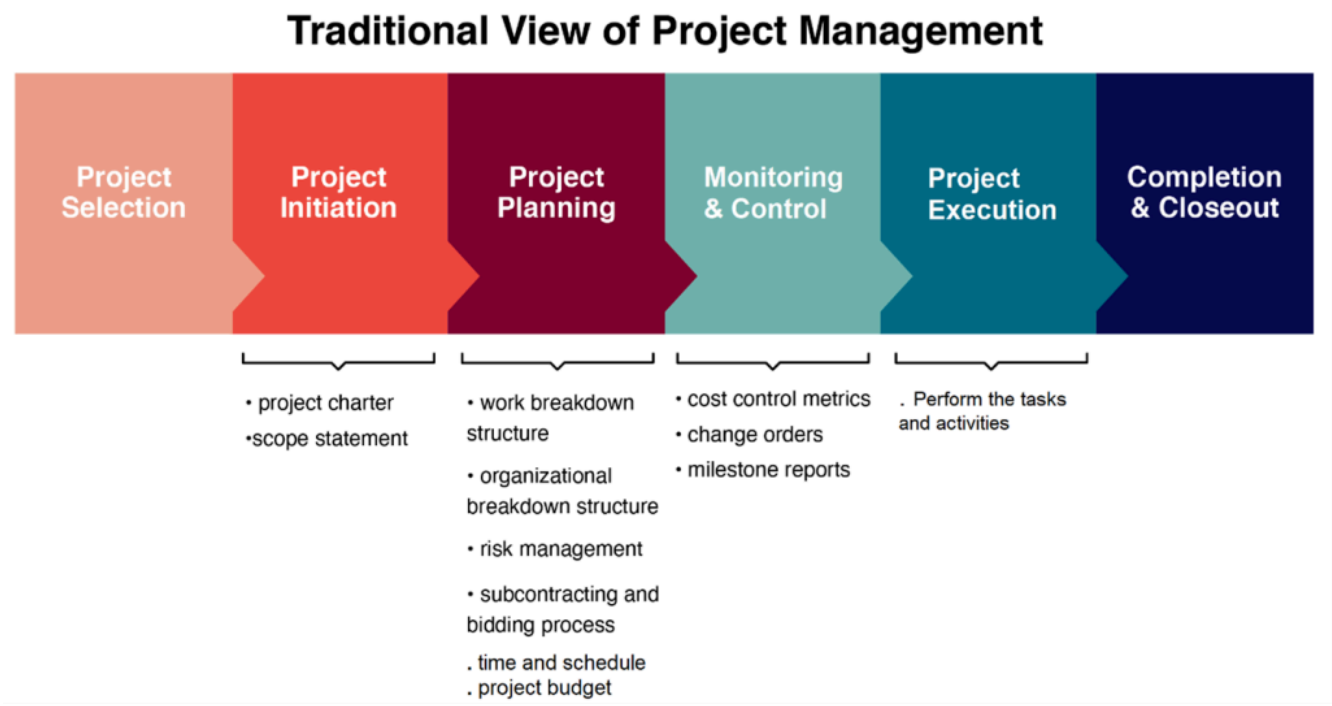

Figure 1.5: Project phases

1.7. Planning

After the project has been defined and the project team has been appointed, you are ready to enter the second phase in the project management life cycle: the detailed *project planning* phase.

Project planning is at the heart of the project life cycle and tells everyone involved where you're going and how you're going to get there. The **planning phase** is when the project plans are documented, the project deliverables and requirements are defined, and the project schedule is created. It involves creating a set of plans to help guide your team through the implementation and closure phases of the project. The plans created during this phase will help you manage time, cost, quality, changes, risk, and related issues. They will also help you control staff and external suppliers to ensure that you deliver the project on time, within budget and schedule.

The project planning phase is often the most challenging phase for a project manager, as you need to make an educated guess about the staff, resources, and equipment needed to complete your project. You may also need to plan your communications and procurement activities, as well as contract any third-party suppliers. The purpose of the project planning phase is to:

- Establish business requirements
- Establish cost, schedule, list of deliverables, and delivery dates
- Establish resources plans
- Obtain management approval and proceed to the next phase

Merriam-Webster's definition of **planning** is "the act or process of making a plan to achieve or do something." This suggests that the ultimate goal of planning is the plan itself. It also presumes that once a plan has been formulated, you only need to follow the plan to achieve the desired outcome. That's fine for ordinary conversation. But when we begin to think about living order project planning, a more expansive understanding of the nature of planning emerges. In living order, planning is a process that prepares the project team to respond to events as they actually unfold. The whole point of planning is to develop strategies to manage the:

- Changes to scope
- Schedule
- Cost
- Quality
- Resources
- Communication
- Risk
- Procurement
- Stakeholder engagement

Planning results in a plan, but the plan is not an end in itself. Rather, a plan is a strategic framework for the scheduling and execution of a project. It's only useful if it includes the information team members require to begin moving forward. And it only remains useful if team members modify the plan as they learn the following about the project:

- Key constraints such as the timeline, cost, and functional requirements.

- Information on project system issues, such as workflow and milestones, provides a broad look at the project as a whole.
- Plans for periodic check-ins that allow participants and leadership to re-evaluate the project and its original assumptions

Die-hard geometric order planners take a **deterministic approach**, labouring under the false notion that once everyone agrees on a plan, the plan itself determines what comes next. Indeed, it is tempting to think you can nail down every detail at the beginning of a project and then get going without looking back. However, effective living order planners understand that these details are nearly always provisional and subject to change, especially early in a project. Thus, effective living order planners stand ready to alter their plans in response to what they learn in changing conditions. They also understand that the context in which a project unfolds has varying levels of detail and variability, with potentially thousands of decisions made over the project's life cycle.

As Alexander Laufer and Gregory Howell explained in an article for Project Management Journal, a project leader's work is founded on uncertainty (Howell et al., 1993). Uncertainty is not an exceptional state in an otherwise predictable process of work, they argue. Instead, it is a permanent feature of modern work. What's more, the longer the time between planning and implementation, the higher the uncertainty surrounding individual activities. Naturally, the higher the uncertainty in a project, the more difficult it is to plan and the less effective the plans will be at articulating actions and outcomes. Finally, they emphasize that no amount of planning can eliminate the variability intrinsic to the work of a complex project.

1.8. Execution

During the third phase, the implementation phase, the project plan is put into motion and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored in order to make appropriate adjustments as required, which are then recorded as variances from the original plan. In any project, a project manager spends most of the time in this step. During project implementation, people are carrying out the tasks, and progress information is reported through regular team meetings. The project manager uses this information to maintain control over the direction of the project by comparing the progress reports with the project plan to measure the performance of the project activities and take corrective action as needed. The first course of action should always be to bring the project back on course (i.e., to return it to the original plan). If that cannot happen, the team should record variations from the original plan and record and publish modifications to the plan. Throughout this step, project sponsors and other key stakeholders should be kept informed of the project's status according to the agreed-on frequency and format of communication. The plan should be updated and published on a regular basis.

Status reports should always emphasize the anticipated endpoint in terms of cost, schedule, and quality of deliverables. Each project deliverable produced should be reviewed for quality and measured against the acceptance criteria. Once all of the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

After you have carefully planned your project, you will be ready to start the project implementation phase, the third phase of the project management life cycle. The implementation phase involves putting the project plan into action. It's here that the project manager will coordinate and direct project resources to meet the objectives of the project plan. As the project unfolds, it's the project manager's job to direct and manage each activity, every step of the way. That's what happens in the implementation phase of the project life cycle: you follow the plan you've put together and handle any problems that come up.

The implementation phase is where you and your project team actually do the project work to produce the deliverables. The word "**deliverable**" means anything your project delivers. The deliverables for your project include all of the products or services that you and your team are performing for the client, customer, or sponsor, including all the project management documents that you put together.

The steps undertaken to build each deliverable will vary depending on the type of project you are undertaking and cannot, therefore, be described here in any real detail. For instance, engineering and telecommunications projects will focus on using equipment, resources, and materials to construct each project deliverable, whereas computer software projects may require the development and implementation of software code routines to produce each project deliverable. The activities required to build each deliverable will be clearly specified within the project requirements document and project plan.

Your job as a project manager is to direct the work, but you need to do more than deliver the results. You also need to keep track of how well your team performs. The implementation phase keeps the project plan on track with careful monitoring and control processes to ensure the final deliverable meets the acceptance criteria set by the customer. This phase is typically where approved changes are implemented.

Most often, changes are identified by looking at performance and quality control data. Routine performance and quality control measurements should be evaluated on a regular basis throughout the implementation

phase. Gathering reports on those measurements will help you determine where the problem is and recommend changes to fix it.

1.9. Monitoring

The best project managers succeed through an artful combination of leadership and teamwork, focusing on people and using their emotional intelligence to keep everyone on task and moving forward. But successful project managers also know how to gather data on the health of their projects, analyze that data, and then, based on that analysis, make adjustments to keep their projects on track. In other words, they practice project monitoring, analytics, and control.

Note that most project management publications emphasize the term monitoring and control to refer to this important phase of project management, with no mention of the analysis that allows a project manager to use monitoring data to make decisions. But of course, there's no point in collecting data on a project unless you plan to analyze it for trends that tell you about the current state of the project. For simple, brief projects, that analysis can be a simple matter—you're clearly on schedule, you're clearly under budget—but for complex projects, you'll need to take advantage of finely calibrated data analytics tools. In this chapter, we'll focus on tasks related to monitoring and control, and also investigate the kind of thinking required to properly analyze and act on monitoring data.

Generally speaking, project monitoring and control involves reconciling "projected performance stated in your planning documentation with your team's actual performance" and making changes where necessary to get your project back on track (Peterman, 2016). It occurs simultaneously with project execution because the whole point of monitoring and controlling is making changes as team members perform their tasks. The monitoring part of the equation consists of collecting progress data and sharing it with the people who need to see it in a way that allows them to understand and respond to it. The controlling part consists of making changes in response to that data to avoid missing major milestones. If done right, monitoring and controlling enable project managers to translate information gleaned by monitoring into the action required to control the project's outcome. A good monitoring and control system is like a neural network that sends signals from the senses to the brain about what's going on in the world. The same neural network allows the brain to send signals to the muscles, allowing the body to respond to changing conditions.

Because monitoring and controlling are inextricably tied to accountability, government websites are a good source of suggestions for best practices. According to the state of California, monitoring and controlling involves overseeing all the tasks and metrics necessary to ensure that the approved and authorized project is within scope, on time, and on budget so that the project proceeds with minimal risk. This process involves comparing actual performance with planned performance and taking corrective action to yield the desired outcome when significant differences exist. The monitoring and controlling process is continuously performed throughout the life of the project (California Office of Systems Integration, 2008).

In other words, monitoring is about collecting data. Controlling is about analyzing that data and making decisions about corrective action. Taken as a whole, monitoring and controlling is about gathering intelligence and using it in an effective manner to make changes as necessary. Precise data are worthless unless they are analyzed intelligently and used to improve project execution. At the same time, project execution is uninformed by the latest data on changing currents in the project, which can lead to disaster.

Active Control takes a two-pronged approach:

- *Controlling* what you can by making sure you understand what's important, taking meaningful measurements, and building an effective team focused on project success.
- *Adapting* to what you can't control through early detection and proactive intervention.

The first step in active control is ensuring that the monitoring information is distributed in the proper form and to the right people so that they can respond as necessary. In this way, you need to function as the project's nervous system, sending the right signals to the project's muscles (activity managers, senior managers, clients, and other stakeholders) so they can take action. These actions can take the form of minor adjustments to day-to-day tasks or major adjustments, such as changes to project resources, budget, schedule, or scope.

1.10. Closure

Closing Processes

At the end of a phase of our project, or the entire project, we must get final approval from the customer, archive our records from the project, compile the lessons learned, and pay any outstanding bills. These and several other activities make up the closing processes. Closing processes include:

- Close project or phase
- Close procurements

1.11. Key Terms

Key Terms

- **Active Control:** Takes a two-pronged approach: Controlling what you can by making sure you understand what's important, taking meaningful measurements, and building an effective team focused on project success. Adapting to what you can't control through early detection and proactive intervention.
- **Agile**: is a broad term for project management techniques that are iterative.
- **Closure or Completion phase**: the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders.
- **Compliance Projects:** These are completed to comply with industry or governmental regulations or standards.
- **Cost**: The budget approved for the project includes all necessary expenses needed to deliver the project.
- **Deliverable:** This means anything your project delivers. The deliverables for your project include all of the products or services that you and your team are performing for the client, customer, or sponsor, including all the project management documents that you put together.
- **Deterministic Approach:** The idea that once everyone agrees on a plan, the plan itself determines what comes next.
- **Function Point Analysis:** a set of rules to measure the functionality to users
- **Implementation:** the project plan is put into motion and the project's work is performed.
- **Initiation:** the project objective or need is identified; this can be a business problem or opportunity.
- **Iterative**: repetitive
- **Life Cycle**: The path a project takes from the beginning to its end.
- **Operations:** Involve continuous work without an ending date and with the same processes repeated to produce the same results.
- **Operational Projects:** Improve current operations. These projects may not produce radical improvements, but they will reduce costs, get work done more efficiently, or produce a higher-quality product.
- **Planning:** The act or process of making a plan to achieve or do something.
- **Planning Phase:** When the project plans are documented, the project deliverables and requirements are defined, and the project schedule is created. It involves creating a set of plans to help guide your team through the implementation and closure phases of the project.
- **Program**: When a group of projects is arranged towards achieving a specific goal. A cluster of interconnected projects.
- **Project(s):** Temporary initiatives that companies implement alongside their ongoing operations to achieve specific goals. They are clearly defined packages of work, bound by deadlines and

endowed with resources, including budgets, people, and facilities.

- **Project Management:** Has a dual nature; it is both a series of distinct phases with a clear beginning and end and a continuous, circular process in which each end leads to a new beginning.
- **Quality:** A combination of the standards and criteria to which the project's products must be delivered for them to perform effectively.
- **Quality Assurance (QA)**: The process of evaluating overall project performance regularly to provide confidence that the project will satisfy the relevant quality standards.
- **Risk Management:** Anticipating and identifying potential problems that would threaten the success of the project and developing a plan to reduce the impact of that threat if it occurs.
- **Scope:** The reason and purpose for the project, or what the project is trying to achieve.
- **Scope Management:** The strategy designed to recognize and organize the project's tasks and resources.
- **Strategic projects**: Involve creating something new and innovative. A new product, a new service, a new retail location, a new branch or division, or even a new factory might be a strategic project because it will allow an organization to gain a strategic advantage over its competitors.
- **Time**: is defined as the time to complete the project. Time is often the most frequent project oversight in developing projects.
- **Triple constraint**: The primary competing project constraints, which traditionally consisted of only time, cost, and scope.
- **Waterfall:** A project management approach where phases are presented sequentially.

CHAPTER 2 - PROJECT MANAGEMENT - THE INITIATION PHASE

Chapter Overview

2.1. Chapter Introduction

Learning Objectives

By the end of this chapter, you should be able to:

1. Explain the three broad categories of projects.
2. Discuss SMART criteria for developing and defining projects.
3. Describe the elements of a project charter and explain its role in the initiation phase.
4. Explain issues related to the project scope.
5. Outline the skills required to lead and manage individuals effectively.
6. Outline the skills required to lead and manage project teams effectively.
7. Explain the differences between the three types of project meetings.

2.2. Strategic Alignment

The project initiation phase is the first phase within the project management life cycle, as it involves starting up a new project. Within the initiation phase, the business problem or opportunity is identified, a solution is defined, a project is formed, and a project team is appointed to build and deliver the solution to the customer. A business case/proposal (sometimes called a feasibility study) is created to define the problem or opportunity in detail and identify a preferred solution for implementation. The business case/proposal includes:

- A detailed description of the problem or opportunity with headings such as Introduction, Business Objectives, Problem/Opportunity Statement, Assumptions, and Constraints
- A list of the alternative solutions available
- An analysis of the business benefits, costs, risks, and issues
- A description of the preferred solution
- Main project requirements
- A summarized plan for implementation that includes a schedule and financial analysis

SMART Project Objectives

In the early 1980s, George T. Doran introduced the SMART set of criteria for projects, goals and objectives. **SMART** is an acronym for Specific, Measurable, Assignable, Realistic, and Time-Related. The smart criteria have been applied in many different areas of management, including project management. Let's take a look at each of Doran's criteria as they apply to project management.

Specific – A project needs to be specific about what it will accomplish. Unlike many organizational goals, the goal of a project should not be vague or nebulous. An organization may want to "make London, Ontario a great place to live," but its projects need to focus on a specific goal. For example, a more specific goal would be to build a downtown farmers' market. A project that is specific is one that can be clearly communicated to all team members and stakeholders. A specific project goal will answer the five 'W' questions:

1. **W**hat do we want to accomplish?
2. **W**hy are we undertaking this project?
3. **W**ho is involved or will be affected by the project?
4. **W**here will this project be conducted?
5. **W**hich constraints (scope, time, money, risk, etc.) have been placed on our project?

Measurable – How will project progress and success be measured? What will be the measurable difference once our project is completed successfully? These measures should be quantifiable.

Assignable – Who will do the work? Can people be identified who have the expertise in the organization to complete this work? Or can the expertise be hired from outside of the organization?

Realistic – Is it realistic that the organization can achieve this project, given its talents and resources? This is a

very important consideration for businesses of all sizes. Yes, it would be great to produce a new driverless car, but is that realistic, given the resources that the organization has available?

Time-related – when will the project be completed, and how long will it take? These criteria can be very useful when defining a project. If the description for a project does not meet all these criteria, then it is time to go back to the drawing board and make sure that what is being described is really a project rather than a program or strategic goal.

Example

For example, an objective of the team principal (project manager) of a Formula 1 racing team may be that their star driver "finish the lap as fast as possible." That objective is filled with ambiguity.

How fast is "fast as possible?" Does that mean the fastest lap time (the time to complete one lap), or does it mean the fastest speed as the car crosses the start/finish line (that is, at the finish of the lap)?

When should the driver be able to achieve the objective? It is no use having the fastest lap after the race has finished, and equally, the fastest lap does not count for qualifying and, therefore, starting position if it is performed during a practice session.

Figure 2.1: Monaco 2004 by Cord Rodefeld, CC BY 2.0

2.3. Weighted Decision Matrix

A **weighted decision matrix** is a decision tool used by decision-makers.

A decision matrix is basically an array presenting on one axis a list of alternatives, also called options or solutions. On the other axis is a list of criteria, which are weighted depending on their respective importance in the final decision to be taken.

The example in Figure 2.2 shows a weighted decision matrix that compared three options for a web development project (SJS Enterprises). This method is beneficial when choosing purchase alternatives and comparing them against specific desirable system requirements.

Table 2.1: Weighted Decision Matrix for Game Delivery System

Criteria	**Weight**	**SJS Enterprises**	**Game Access**	**DVD Link**
Educational	15%	90	0	0
Sports-related	15%	90	90	90
Secure payment area with the ability to use Paypal, bank payments, cheques, school payment systems as a payment source	10%	90	50	50
Live Support	15%	90	0	0
Search Option	5%	50	50	30
Games available for all platforms currently on the market including school learning systems	10%	60	30	30
Longer Rental Periods (1 to 2 weeks)	5%	40	20	40
Sidebar with categories such as most popular, multiplayer, and just released	5%	50	50	20
Registered customers must be able to order the videos, track delivery, return of videos and be able to provide reviews of views	10%	50	30	30
Age/grade appropriate section (can isolate certain games to certain ages or grade levels)	10%	70	5	0
Weighted Project Scores	**100%**	**74.5**	**31**	**29**

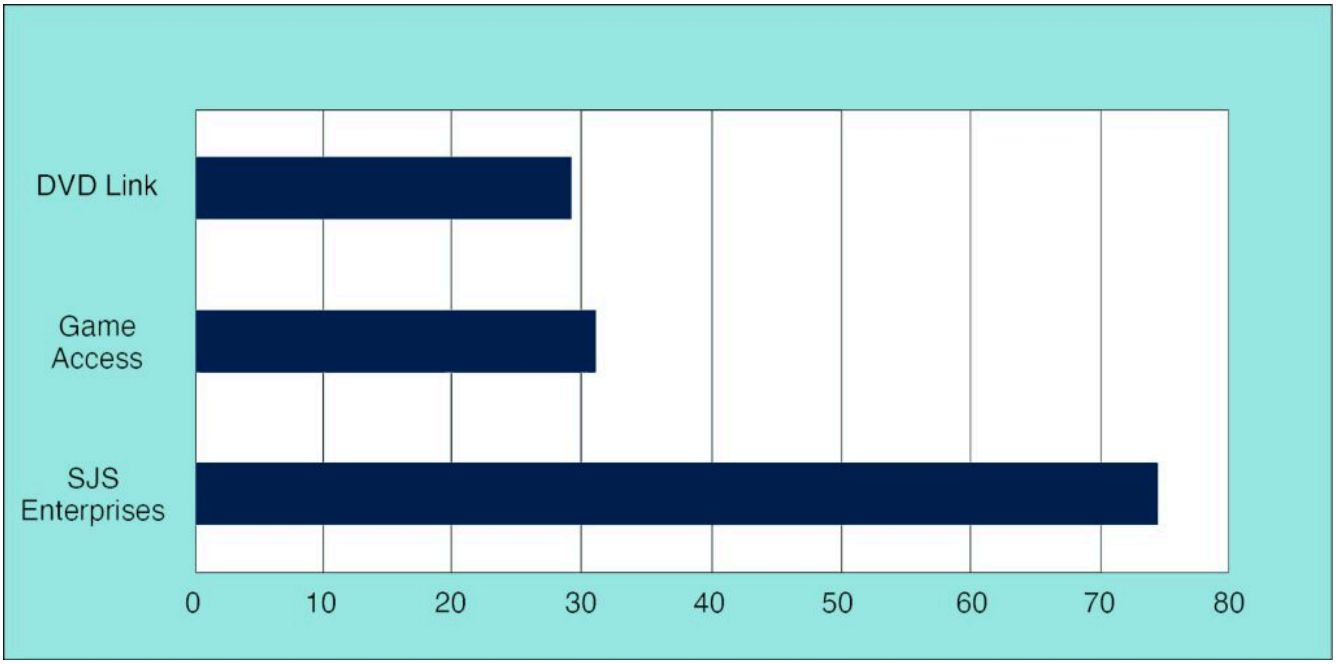

Figure 2.2 Weighted decision matrix score for the game delivery project. The graphic is based on data in the table above.

Comparing Options Using a Weighted Decision Matrix

Sometimes, we have multiple options to choose from when determining requirements and deciding which project to work on. We can use tools such as a weighted decision matrix to select the best option.

A basic decision matrix consists of establishing a set of criteria for options that are scored and summed to gain a total score that can then be ranked. Importantly, it is not weighted to allow a quick selection process.

A weighted decision matrix operates in the same way as the basic decision matrix but introduces the concept of weighting the criteria in order of importance. The resultant scores better reflect the importance of the criteria involved to the decision maker. The more important a criterion, the higher the weighting it should be given. Each of the potential options is scored and then multiplied by the weighting given to each of the criteria to produce a result.

The advantage of the weighted decision matrix is that subjective opinions about one alternative versus another can be made more objective. Another advantage of this method is that sensitivity studies can be performed. An example of this might be to see how much your opinion would have to change in order for a lower-ranked alternative to outrank a competing alternative.

A weighted decision matrix, therefore, allows decision-makers to structure and solve their problems by:

1. Specifying and prioritizing their needs with a list of criteria, then
2. Evaluating, rating, and comparing the different solutions; and
3. Selecting the best matching solution.

2.4. Project Charter

What is the Project Charter?

A **project charter**, project definition, or project statement is a statement of the scope, objectives, and participants in a project. It provides a preliminary delineation of roles and responsibilities, outlines the project objectives, identifies the main stakeholders, and defines the authority of the project manager. It serves as a reference of authority for the future of the project.

The charter document can be just a couple of pages in length or can be 50-100 pages. Ideally, it will be short (less than 5 pages) and written in clear and concise language so that anyone who reads it will have a clear understanding of the project, regardless of their technical background. Most project charters include a place at the end of the document for approval and sign-off by the project sponsors or customers (i.e., those people who are paying for the project).

Purpose of the Project Charter

The project charter is used by the project manager during the planning process. The project charter informs the project manager about what skills will be required on the project team, as well as the general scope of work for the project. Some organizations forgo the creation of a project charter, viewing it as a document that merely takes time to create and contains information that "everyone already knows." This can be a big mistake. The charter can be referenced by the project manager and stakeholders if some of the goals of the project are not met or they are asked to do something outside the scope of the project. A well-drafted project charter can prevent political interference in achieving the goals of the project and reduce scope creep.

In summary, the purpose of a project charter is to:

- Provide an understanding of the project, the reason it is being conducted, and its justification.
- Establish the general scope of the project early on.
- Establish the project manager and his or her authority level. A note of who will review and approve the project charter must be included.

What Should Be in the Project Charter?

There are many templates available for project charters, and these vary greatly in content and level of detail. (The PMI-affiliated website ProjectManagement.com offers a number of project charter templates) At a minimum, good project charters will contain the following sections.

Background

The background should provide a broad overview of the project and answer the following questions:

- What is the purpose of the project?
- Where did the project originate? Have we conducted similar projects in the past?
- Who is the project manager, and what level of authority does the project manager have?

Business Case

The Business Case describes why this project was selected over others and answers the following questions:

- Why was this project selected to move forward (project justification)? What selection criteria were used? (Project selection techniques are covered in a later chapter.)
- What problems is this project solving or what opportunities is it creating? What are the high-level requirements?

Goals

Listing the goals for the project ensures that the stakeholders will not be disappointed when the project is completed. This section should answer the following questions:

- What are the broad goals of this project?
- How will we know if the project is a success (what are our metrics for success)?
- Are there industry standards that we are trying to meet or benchmarks for performance that we want this project to attain?

Key Stakeholders

This section describes the key stakeholders and their interest in the project. This doesn't have to be an exhaustive list of stakeholders; it should contain a list of people who are interested in the project as well as people who will pay for or benefit from the project.

Deliverables

A project is said to have deliverables as products or services. They are things such as physical objects, software code, or events that make up the project, and they are written in the form of nouns, for example, floor, walls, electrical...etc.

Major Milestones

This section provides a summary of the major milestones for the project. A listing of any hard deadlines for the project should be included. Milestones can relate to project work (when are major deliverables expected to be complete?) as well as invoicing and payment deadlines.

Project Budget

The project budget section should provide a summary of the budget for the project and information about how it was determined. It answers the following questions:

- What is the initial budget for this project?
- How was that budget developed?
- Are the numbers used for budgeting rough estimates based on top-down estimation techniques, such as analogous or parametric estimating, or are they hard constraints?
- What contingency funds have been allocated?

2.5. Project Scope

You always want to know exactly what work has to be done before you start it. You have a collection of team members, and you need to know exactly what they're going to do to meet the project's objectives. The scope planning process is the very first thing you do to manage your scope. **Project scope planning** is concerned with the definition of all the work needed to successfully meet the project objectives. The whole idea here is that when you start the project, you need to have a clear picture of all the work that needs to happen on your project, and as the project progresses, you need to keep that scope up to date and documented in the project's scope management plan.

Defining the Scope

You already have a head start on refining the project's objectives in quantifiable terms, but now you need to plan further and write down all the intermediate and final deliverables that you and your team will produce over the course of the project. Deliverables include everything that you and your team produce for the project (i.e., anything that your project will deliver). The deliverables for your project include all of the products or services that you and your team are performing for the client, customer, or sponsor. They include every intermediate document, plan, schedule, budget, blueprint, and anything else that will be made along the way, including all of the project management documents you put together. Project deliverables are tangible outcomes, measurable results, or specific items that must be produced to consider either the project or the project phase completed. Intermediate deliverables, like the objectives, must be specific and verifiable.

All deliverables must be described in a sufficient level of detail so that they can be differentiated from related deliverables. For example:

- A twin-engine plane versus a single-engine plane
- A red marker versus a green marker
- A daily report versus a weekly report
- A departmental solution versus an enterprise solution

One of the project managers' primary functions is to document the deliverables of the project accurately and then manage the project so that they are produced according to the agreed-on criteria. Deliverables are the output of each development phase, described in a quantifiable way.

Project Requirements

After all the deliverables are identified, the project manager needs to document all the requirements of the project. Requirements describe the characteristics of the final deliverable, whether it is a product or a service. They describe the required functionality that the final deliverable must have or specific conditions the final deliverable must meet in order to satisfy the objectives of the project. A requirement is an objective that must be met. The project's requirements, defined in the scope plan, describe what a project is supposed to accomplish and how the project is supposed to be created and implemented. Requirements answer the following questions regarding the as-is and to-be states of the business: who, what, where, when, how much, and how does a business process work?

Requirements may include attributes such as dimensions, ease of use, colour, and specific ingredients. If we go back to the example of the company producing holiday eggnog, one of the major deliverables is the

cartons that hold the eggnog. The requirements for that deliverable may include carton design, photographs that will appear on the carton, and colour choices.

Requirements specify what the final project deliverable should look like and what it should do. Requirements must be measurable, testable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design. They can be divided into six basic categories: functional, non-functional, technical, business, user, and regulatory requirements.

Functional Requirements

Functional requirements describe the characteristics of the final deliverable in ordinary non-technical language. They should be understandable to the customers, and the customers should play a direct role in their development. Functional requirements are what you want the deliverable to do.

Vehicle Example: If you were buying vehicles for a business, your functional requirement might be: "The vehicles should be able to take up to a one-ton load from a warehouse to a shop."

Computer System Example: For a computer system, you may define what the system is to do: "The system should store all details of a customer's order."

The important point to note is that what is wanted is specified and not how it will be delivered.

Non-functional Requirements

Non-functional requirements specify criteria that can be used to judge the final product or service that your project delivers. There are restrictions or constraints to be placed on the deliverable and how to build it. Their purpose is to restrict the number of solutions that will meet a set of requirements. Using the vehicle example, the functional requirement is for a vehicle to take a load from a warehouse to a shop. Without any constraints, the solutions being offered might result in anything from a small to a large truck. Non-functional requirements can be split into two types: performance and development. To restrict the types of solutions, you might include these performance constraints:

- The purchased trucks should be American-made trucks due to government incentives.
- The load area must be covered.
- The load area must have a height of at least 10 feet.

As mentioned earlier in Chapter 1, projects have constraints that can be categorized according to the type of requirements. There are three general types of non-functional development constraints:

- *Time***:** When a deliverable should be delivered
- *Cost:* How much money is available to develop the deliverable
- *Quality***:** Any standards that are used to develop the deliverable, development methods, etc.

Technical Requirements

Technical requirements emerge from the functional requirements to answer the following questions: How will the problem be solved this time, and will it be solved technologically and/or procedurally? They specify how the system needs to be designed and implemented to provide the required functionality and fulfill the required operational characteristics.

For example, in a software project, the functional requirements may stipulate that a database system will be developed to allow access to financial data through a remote terminal. The corresponding technical requirements would spell out the required data elements, the language in which the database management system will be written (due to existing knowledge in-house), the hardware on which the system will run (due to existing infrastructure), telecommunication protocols that should be used, and so forth.

Business Requirements

Business requirements are the needs of the sponsoring organization, always from a management perspective. Business requirements are statements of the business rationale for the project. They are usually expressed in broad outcomes, satisfying the business needs rather than specific functions the system must perform. These requirements grow out of the vision for the product that, in turn, is driven by mission (or business) goals and objectives.

User Requirements

User requirements describe what the users need to do with the system or product. The focus is on the user experience with the system under all scenarios. These requirements are the input for the next development phases: user-interface design and system test cases design.

Regulatory Requirements

Regulatory requirements can be internal or external and are usually non-negotiable. They are the restrictions, licenses, and laws applicable to a product or business that are imposed by the government.

Measuring Requirements

Requirements Traceability Matrix

The requirements traceability matrix is a table that links requirements to their origin and traces them throughout the project life cycle. The implementation of a requirements traceability matrix helps ensure that each requirement adds business value by linking it to the business and project objectives. It provides a means to track requirements throughout the project life cycle, helping to ensure that requirements approved in the requirements documentation are delivered at the end of the project. Finally, it provides a structure for managing changes to the product scope. This process includes, but is not limited to, tracking:

- Requirements for business needs, opportunities, goals, and objectives
- Requirements for project objectives
- Requirements for project scope/work breakdown structure deliverables
- Requirements for product design
- Requirements for product development
- Requirements for test strategy and test scenarios
- High-level requirements to more detailed requirements

Attributes associated with each requirement can be recorded in the requirements traceability matrix. These attributes help to define key information about the requirement. Typical attributes used in the requirements traceability matrix may include a unique identifier, a textual description of the requirement, the rationale for inclusion, owner, source, priority, version, current status (such as active, cancelled, deferred, added, approved),

and date completed. Additional attributes to ensure that the requirement has met stakeholders' satisfaction may include stability, complexity, and acceptance criteria.

2.6. Managing the Scope

Time, cost, and scope are known as the triple constraints of project management. It's not possible to change one without changing at least one of the others. If the project takes twice as long as expected to complete, then the cost will almost certainly go up. On the other hand, a decision to cut costs, perhaps by using less experienced labour, could lead to a work slowdown, extending the schedule. Such a decision might also result in a change to the project's scope, perhaps in the form of a lower-quality product.

The initiation phase is too early in the project to nail down precise details about time and cost, but it is a good time to think long and hard about scope, which is "all of the work that needs to be done to provide the product or service your project is delivering" (Martinez, n.d.). In this early stage, you and the project stakeholders might do some blue-sky thinking about what your project could possibly achieve without regard to the constraints of time, cost, and scope. But before too long, you'll need to zero in on a definition of the project's scope, formalize it as a scope statement, and use the information currently available to you.

Except for the simplest projects, any scope definition will almost certainly evolve as you learn more about the project and the customer's needs. The term **scope evolution** refers to changes that all stakeholders agree on and that are accompanied by corresponding changes in budget and schedule. Scope evolution is a natural result of the kind of learning that goes on as a project unfolds. This includes learning that arises from fresh insights into the needs of the end user, new regulations, or upheaval in the marketplace. As long as all stakeholders agree on the scope changes (and the associated changes to the budget and schedule), scope evolution ensures that customers actually get what they want out of the project. The more you talk with the client and learn about their needs, the more you will be able to refine the scope.

Indeed, one of the main jobs of a project manager is managing scope evolution. However, different types of projects will involve varying scope evolutions. For example, if you're working on a project related to satisfying a specific environmental regulation, the initial definition of the project's scope might be clear, requiring little refinement as the project unfolds, as long as the regulation itself is not altered. But if you are working on a product designed to satisfy a brand-new market demand, you might need to refine the scope continually to ensure that you satisfy your customers' needs.

Perhaps the most common cause of **scope evolution** is a change in the context in which a project is planned and executed. Alterations in market forces, changing demographics, new or more vigorous competition, and technological advancements can all change a project's context, forcing you to rethink its scope. This potential for changing contexts means that no two projects are the same.

Scope evolution is managed change. It is an approved alteration to the project scope that occurs as the project participants learn more about the project. It results in an official change in the project scope and, therefore, to the project budget or schedule, as agreed to by all project participants. This kind of managed change is a natural and rational result of the kind of learning that goes on throughout the course of a project. It is a conscious choice necessitated by new information forcing you to reconsider project essentials in order to achieve the intended project value.

***Scope creep** is unmanaged change.* It is caused by uncontrolled changes to the project scope. Such changes might add value from the customer's perspective, but the time, money, and resources consumed by the change of scope lead to additional overruns. Scope creep tends to happen bit by bit because no one is paying close attention to the project's scope. For example, in a kitchen remodelling project intended to replace

countertops and cabinets, deciding at the last minute to replace all appliances might be an example of scope creep.

Creating a Clear Scope Statement

The key to managing scope is a carefully crafted scope statement, which should be clear and precise. The details of how you plan to carry out a project may be vague at first, but what you want to achieve should be perfectly clear. Vagueness can lead to small changes to the project's scope, which in turn lead to other changes until the original project is no longer recognizable.

Writing a **scope statement**, the document that defines the project's scope, is a major part of the initiation phase. However, according to Brad Bigelow (2012), in an article for the Project Management Institute, it is "usually expressed in qualitative terms that leave room for interpretation and misunderstanding. Consequently, it's often the biggest source of conflicts in a project"(p. 1).

To avoid such problems, experienced project managers put a lot of effort into learning what should and shouldn't be included in the project and then articulating these boundaries as clearly as possible in the form of a scope statement. According to Bigelow (2012), this work is essential to ensuring a project's success: "No project's scope can ever be entirely free of fuzziness—free from subjectivity and imperfect definitions—as long as human beings are involved. On the other hand, it's also highly improbable that any project will ever survive initiation if its scope is entirely vague, undefined, and subject to unpredictable expectations" (p. 2).

If the scope is poorly defined, then what is or isn't within the project scope is reduced to a matter of perspective. Not surprisingly, these "different perspectives...can often be the root of conflicts within a project" (Bigelow, 2012, p. 2). Bigelow describes a project in which the team and the customer see things very differently:

> *When the scope is poorly defined, satisfying the customer can grow increasingly difficult, with the team going off and creating what it thinks the customer wants, only to be told, "No, that's not it."*

Opinions vary on exactly what a scope statement should include, but at the very least, it should contain the following:

- A brief justification of the project's purpose, including a summary of the business needs the project will address.
- An explanation of the project's goals.
- Acceptance criteria specify the conditions the product or service must satisfy before the customer will accept the deliverables.
- Deliverables are "the quantifiable goods or services that will be provided upon the completion of a project. Deliverables can be tangible or intangible parts of the development process, and they are often specified functions or characteristics of the project" (Bloomenthal, n.d., para. 1.).
- An explanation of anything excluded from the project—in other words, an explanation of what is out of scope for the project. This list should be "as detailed as is necessary to define the project boundaries to all stakeholders" (Feldsher, 2016, para. 11).
- Constraints, such as budget and schedule.
- Assumptions, including anything you currently believe to be true about the project. It's also helpful to include ideas "about how you will address uncertain information as you conceive, plan, and perform your project" (Portny n.d., 2018).
- An explanation of any new or unusual technology you plan to use throughout the project. This is not a typical part of a scope statement, but "it's likely that stakeholders will appreciate the transparency and feel

more comfortable with the project moving forward" (Feldsher, 2016, para. 13).

Practical Tips

- *Engage all stakeholders:* Your goal is to keep people meaningfully engaged in your project. You don't want stakeholders showing up for ceremonial appearances at project meetings. Instead, you want them seriously focused on the prospects for project success.
- *Outcome clarity:* Ask your customer to define success right at the beginning. Then, working with the customer and other stakeholders, define how success will be measured.
- *Use a common vocabulary:* At the beginning of any project, go to your end customers and learn their vocabulary. Make sure you understand the terms that are important to them and what such terms mean to them. Whenever possible, use your customer's vocabulary, not yours. Also, strive to speak in plain English whenever you can and avoid techno-speak.
- *Create a glossary of terms***:** Consider creating a glossary of terms on projects with a lot of complex jargon. Then, publish it in a way that makes it accessible to all stakeholders, updating it as needed. Here's an example of one such glossary: "COSO Framework ".
- Identify what you don't know: When you start a project, there are always things you don't know. The key is to know that you don't know them. The more you strive to recognize this, the better you will be at predicting those unknowns and making provisions for them.
- *Have key team members sign major project documents:* Research shows that the act of signing a document makes people much more committed to delivering on the promises described in the document. Consider asking the entire project team to sign the project charter and scope documents. This simple act can serve as a powerful inducement to complete the project successfully.
- *Proactive concurrency:* In the early stages, avoid the trap of plotting one thing after another in a linear fashion. Instead, start fast, doing as many things as you can concurrently, as quickly as you can. This will give you a sense of whether or not the scope, budget, resources, and schedule are all in relatively close alignment at the macro scale. If you find they are not, report that to management right away.
- *Permanent urgency***:** In the living order in which all modern projects unfold, permanent urgency is the new law of nature. In the traditional, geometric order form of project management, you could assume that you would have sufficient time and resources to do things in a linear, step-by-step manner. But in the modern world, that's rarely the case. Get used to an element of urgency in all projects. Try not to let this paralyze you and your team. Instead, let a sense of urgency spur you on to more agile, alert, and flexible project management techniques.
- *Post the project documents prominently***:** Putting important documents front and centre helps a team stay focused, especially if you have everyone sign them first. It also encourages the team to update them when necessary.
- *Plan for errors:* You and your team will almost certainly make mistakes, especially in the early stages of a project. Therefore, you should plan for that. Keep thinking ahead to what might go wrong, and how you could correct course.

2.7. Working With Teams

A team is a collaboration of people with different personalities led by a person with a favoured leadership style. Tuckman's team development model – Forming, Storming, Norming, Performing, and Adjourning – is elegant and helpful in explaining team development behaviour. The model explains that relationships are established as the team develops maturity and ability and the leader changes leadership style. Beginning with a direct style, the leader moves through coaching, then participating, finishing with delegating.

Managing the interactions of the various personalities and styles is an important aspect of project management.

Trust

Trust is the foundation for all relationships within a project. Without a minimum level of trust, communication breaks down, and eventually, the project suffers in the form of increasing costs and slipping schedules. Often, when reviewing a project where performance problems have captured the attention of upper management, the evidence of problems is the increase in project costs and the slippage in the project schedule. The underlying cause is usually blamed on communication breakdown. With deeper investigation, the communication breakdown is associated with a breakdown in trust.

On projects, trust is the filter through which we screen shared information and the filter we use to screen the information we receive. The more trust that exists, the easier it is for information to flow through the filters. As trust diminishes, the filters become stronger, information has a harder time getting through, and projects that are highly dependent on an information-rich environment will suffer from information deprivation.

Contracts and Trust Relationships

A project typically begins with a charter or contract. A contract is a legal agreement that includes penalties for any behaviour or results not achieved. Contracts are based on an adversarial paradigm and do not lend themselves to creating an environment of trust. Contracts and charters are necessary to establish the scope of the project, among other things, but they are not conducive to establishing a trusting project culture.

A relationship of mutual trust is less formal but vitally important. When a person or team enters into a relationship of mutual trust, each person's reputation and self-respect are the drivers in meeting the intent of the relationship. A relationship of mutual trust within the context of a project is a commitment to an open and honest relationship. Nothing enforces the commitments in the relationship except the integrity of the people involved. Smaller, less complex projects can operate within the boundaries of a legal contract, but larger, more complex projects must develop a relationship of mutual trust to be successful.

Types of Trust

Svenn Lindskold (1978) describes four kinds of trust:

- *Objective credibility.* A personal characteristic that reflects the truthfulness of an individual that can be checked against observable facts.
- *Attribution of benevolence*. A form of trust that is built on the examination of the person's motives and the conclusion that they are not hostile.

- *Non-manipulative trust*. A form of trust that correlates to a person's self-interest and the predictability of a person's behaviour in acting consistent in that self-interest.
- *High cost of lying*. The type of trust that emerges when persons in authority raise the cost of lying so high that people will not lie because the penalty will be too high.

Creating Trust

Building trust in a project begins with the project manager. On complex projects, the assignment of a project manager with a high trust reputation can help establish the trust level needed. The project manager can also establish the cost of lying in a way that communicates an expectation and a value for trust in the project. Project managers can also ensure that the official goals (stated goals) and operational goals (goals that are reinforced) are aligned. The project manager can create an atmosphere where informal communication is expected and reinforced.

Informal communication is important for establishing personal trust among team members and with the client. Allotting time during project start-up meetings to allow team members to develop personal relationships is important to establishing the team's trust. The informal discussion allows for a deeper understanding of the whole person and creates an atmosphere where trust can emerge.

Example: High Cost of Lying in a Project

On the project in Abu Dhabi, the client was asking for more and more backup information from the project. The project manager visited the client to better understand the reporting requirements and discovered the client did not trust the reports coming from the project and wanted to validate the material for each report. After some candid discussion, the project manager discovered that one of the project team members had provided information to the client that was inaccurate. The team member made a mistake but did not correct it with the client, hoping that the information would get lost in the stream of information from the project. The project manager removed the team member from the project for two main reasons. The project manager established that the cost of lying was high. The removal communicated to the project team an expectation of honesty. The project manager also reinforced a covenant with the client that reinforced the trust in the information the project provided. The requests for additional information declined, and the trust relationship between project personnel and the client remained high.

Small events that reduce trust often take place on a project without anyone remembering what happened to create an environment of distrust. Taking fast and decisive action to establish a high cost of lying, communicating the expectation of honesty, and creating an atmosphere of trust are critical steps a project manager can take to ensure the success of complex projects.

Project managers can also establish expectations of team members to respect individual differences and skills, look and react to the positives, recognize each other's accomplishments, and value people's self-esteem to increase a sense of benevolent intent.

2.8 Types of Teams

Teams can outperform individual team members in several situations. The effort and time invested in developing a team and the work of the team are large investments of project resources, and the payback is critical to project success. Determining when a team is needed and then chartering and supporting the development and work of the team are other critical project management abilities.

Teams are effective in several project situations:

- When no one person has the knowledge, skills, and abilities to either understand or solve the problem
- When a commitment to the solution is needed by large portions of the project team
- When the problem and solution cross-project functions
- When innovation is required

Individuals can outperform teams on some occasions. An individual tackling a problem consumes fewer resources than a team and can operate more efficiently—as long as the solution meets the project's needs. A person is most appropriate in the following situations:

- When speed is important
- When one person has the knowledge, skills, and resources to solve the problem
- When the activities involved in solving the problem are very detailed
- When the actual document needs to be written (Teams can provide input, but writing is a solitary task.)

In addition to knowing when a team is appropriate, the project manager must also understand what type of team will function best.

Functional Teams

A **functional team** refers to the team approach related to the project functions. The engineering team, the procurement team, and the project controls team are examples of functional teams within the project. On a project with a low complexity profile that includes low technological challenges, good team member experience, and a clear scope of work, the project manager can utilize well-defined functional teams with clear expectations, direction, and strong vertical communication.

Cross-Functional Teams

Cross-functional teams address issues and work processes that include two or more of the functional teams. The team members are selected to bring their functional expertise to address project opportunities.

Problem-Solving Teams

Problem-solving teams are assigned to address specific issues that arise during the life of the project. The project leadership includes members who have the expertise to address the problem. The team is chartered to address that problem and then disband.

Qualitative Assessment of Project Performance

Project managers should provide an opportunity to ask such questions as “What is your gut feeling about how the project is going?” and “How do you think our client perceives the project?” This creates the opportunity for reflection and dialogue around larger issues on the project. The project manager creates an atmosphere for the team to go beyond the data and search for meaning. This type of discussion and reflection is very difficult in the stress of day-to-day problem-solving.

The project manager has several tools for developing good quantitative information—based on numbers and measurements—such as the project schedules, budgets and budget reports, risk analysis, and goal tracking. This quantitative information is essential to understanding the current status and trends of the project. Just as important is the development of qualitative information—comparisons of qualities—such as judgments made by expert team members that go beyond the quantitative data provided in a report. Some would label this the “gut feeling” or intuition of experienced project managers.

The Humm Factor is a survey tool developed by Russ Darnall to capture the thoughts of project participants. It derived its name from a project manager who always claimed he could tell you more by listening to the hum of the project than by reading all the project reports. “Do you feel the project is doing the things it needs to do to stay on schedule?” and “Is the project team focused on project goals?” are the types of questions that can be included in the Humm Factor. It is distributed on a weekly or less frequent basis, depending on the complexity profile of the project. A project with a high level of complexity due to team-based and cultural issues will be surveyed more frequently.

The qualitative responses are converted to a quantitative value as a score from 1 to 10. Responses are tracked by individuals and the total project, resulting in qualitative comparisons over time. The project team reviews the ratings regularly, looking for trends that indicate an issue may be emerging on the project that might need exploring.

Example: Humm Survey Uncovers Concerns

On the project in Abu Dhabi, the project surveyed the project leadership with a Humm Survey each week. The Humm Factor indicated an increasing worry about the schedule beginning to slip when the schedule reports indicated that everything was according to plan. When the project manager began trying to understand why the Humm Factor was showing concerns about the schedule, he discovered an apprehension about the performance of a critical project supplier. When he asked team members, they responded, “It was the way they answered the phone or the hesitation when providing information—something didn’t feel right.”The procurement manager visited the supplier and discovered the company was experiencing financial problems and had serious cash flow problems. The project manager was able to develop a plan to help the supplier through the period, and the supplier eventually recovered. The project was able to meet performance goals. The Humm Factor survey provided a tool for members of the project team to express concerns that were based on very soft data, and the project team was able to discover a potential problem.

Another project team used the Humm Factor to survey the client monthly. The completed surveys

went to a person who was not on the project team to provide anonymity to the responses. The responses were discussed at the monthly project review meetings, and the project manager summarized the results and addressed all the concerns expressed in the report. “I don’t feel my concerns are being heard” was one response that began increasing during the project, and the project manager spent a significant portion of the next project review meeting attempting to understand what this meant. The team discovered that as the project progressed toward major milestones, the project team became more focused on solving daily problems, spent more time in meetings, and their workday was becoming longer. The result was fewer contacts with the clients, slower responses in returning phone calls, and much fewer coffee breaks where team members could casually discuss the project with the client.

The result of the conversation led to a better understanding by both the project team and client team of the change in behaviour based on the current phase of the project and the commitment to developing more frequent informal discussions about the project.

Creating a Project Culture

Project managers have a unique opportunity during the start-up of a project. They create a project culture, something organizational managers seldom have a chance to do. In most organizations, the corporate or organizational culture has developed over the life of the organization, and people associated with the organization understand what is valued, what has status, and what behaviours are expected. Edgar Schein identified three distinct levels in organizational culture:

1. Artifacts and behaviours
2. Espoused values
3. Assumptions

Artifacts are visible elements in a culture, and they can be recognized by people who are not part of the culture. Espoused values are the organization’s stated values and rules of behaviour. Shared basic assumptions are the deeply embedded, taken-for-granted behaviours that are usually unconscious but constitute the essence of culture.

Characteristics of Project Culture

A **project culture** represents the shared norms, beliefs, values, and assumptions of the project team. Understanding the unique aspects of a project culture and developing an appropriate culture to match the complexity profile of the project are important project management abilities.

Culture is developed through the communication of:

- The priority
- The given status
- The alignment of official and operational rules

Official rules are the rules that are stated, and operational rules are the rules that are enforced. Project

managers who align official and operational rules are more effective in developing a clear and strong project culture because the project rules are among the first aspects of the project culture to which team members are exposed when assigned to the project.

Example: Creating a Culture of Collaboration

A project manager met with his team prior to the beginning of an instructional design project. The team was excited about the prestigious project and the potential for career advancement involved. With this increased competitive aspect came the danger of selfishness and backstabbing. The project leadership team told stories of previous projects where people were fired for breaking down the team efforts and often shared inspirational examples of how teamwork created unprecedented successes—an example of storytelling. Every project meeting started with teambuilding exercises—a ritual—and any display of hostility or separatism was forbidden—taboo—and was quickly and strongly cut off by the project leadership if it occurred.

Culture guides behaviour and communicates what is important and is useful for establishing priorities. On projects that have a strong culture of trust, team members feel free to challenge anyone who breaks confidence, even managers. The culture of integrity is stronger than the cultural aspects of the power of management.

Innovation on Projects

The requirement for innovation in projects is influenced by the nature of the project. Some projects are chartered to develop a solution to a problem, and innovation is a central ingredient of project success. The lack of education available to the world at large prompted the open education movement, a highly innovative endeavour that resulted in the textbook you are now reading. Innovation is also important to developing methods of lowering costs or shortening the schedule. Traditional project management thinking provides a trade-off between cost, quality, and schedule. A project sponsor can typically shorten the project schedule with an investment of more money or a lowering of quality. Finding innovative solutions can sometimes lower costs while also saving time and maintaining quality.

Innovation is a creative process that requires both fun and focus. Stress is a biological reaction to perceived threats. Stress, at appropriate levels, can make the work environment interesting and even challenging. Many people working on projects enjoy a high-stress, exciting environment. When the stress level is too high, the biological reaction increases blood flow to the emotional parts of the brain and decreases the blood flow to the creative parts of the brain, making creative problem-solving more difficult. Fun reduces the amount of stress on the project. Project managers recognize the benefits of balancing the stress level on the project with the need to create an atmosphere that enables creative thought.

Example: Stress Managed on a Website Design Project

When a project manager visited the team tasked with designing the website for a project, she found that most of the members were feeling a great deal of stress. As she probed to find the reason behind the stress, she found that in addition to designing, the team was increasingly facing the need to build the website as well. As few of them had the necessary skills, they were wasting time that could be spent designing and trying to learn building skills. Once the project manager was able to identify the stress as well as its cause, she was able to provide the team with the support it needed to be successful.

Exploring opportunities to create savings takes time and energy, and on a time-sensitive project, the project manager must create the motivation and the opportunity for creative thinking.

2.9 Team Meetings

Team meetings are conducted differently depending on the purpose of the meeting, the leadership style that is appropriate for the meeting, and the personality types of the members of the team.

Action Item Meetings

Action item meetings are short meetings to develop a common understanding of the short-term priorities for the project, individual roles, and expectations for specific activities. This type of meeting is for sharing, not problem-solving. Any problems that emerge from the discussion are assigned to a person, and another meeting is established to address the issue. Action item meetings focus on short-term activities, usually less than a week in duration.

The action item meeting is fact-based and information-oriented. It is a left-brain-type focus. The action item meeting has very little dialogue except to ask clarification questions. If discussion is needed or disagreement is not easily resolved, another problem-solving meeting is established to deal with that issue. On smaller topics, that meeting might take place immediately after the action item meeting and only include those people with an interest in the outcome of the discussion.

The project manager keeps the successful action item meeting short in duration and focuses on only those items of information needed for the short-term project plan. The project manager will restate the common understanding of what activities are priorities and who will be responsible for the activities. Often, these meetings can include a review of safety procedures or security procedures when these issues are important to the project. The leadership approach to action item meetings focuses on data, actions, and commitments. Although the project manager may observe stresses between project team members or other issues, they are not addressed in this meeting. These are fact-based meetings. If issues begin to arise between people, the project manager will develop other opportunities to address these issues in another forum. Using the Myers-Briggs descriptions, team members who favor thinking more than feeling and judging more than perceiving are more comfortable with this type of meeting.

Management Meetings

Management meetings are longer and are focused on planning. They are oriented toward developing plans, tracking the progress of existing plans, and making adjustments to plans in response to new information.

These meetings include focused discussions on generating a common understanding of the progress of the existing plan. This discussion is based on quantitative information provided on the progress of the schedule and other data, but the discussion is qualitative in evaluating the data to develop a more complete understanding of the data. The experience and opinions of the project leaders are solicited, and disagreement about the meaning of the data is even encouraged to develop a deeper understanding of the data. Through this discussion, a common understanding of the status of the project should emerge, and the project manager invites discussion, invites people to offer their thoughts, and assures that disagreements are positive discussions about the interpretation of the information and that disagreements do not become personal.

Management meetings also focus on developing mid-term goals. For larger, more complex projects, the goals may be monthly or even quarterly. For smaller or less complex projects, weekly goals will provide the focus. The project manager focuses the discussion on the broad priorities for the next period and includes all the functional leaders in the discussion. The goals that emerge from the discussion should represent a common

understanding of the priorities of the project for the next term.
is typically the completion of the conceptual plan. The project manager would lead a discussion on what needs to be accomplished to meet the project milestone and asks what potential barriers exist and what key resources are needed. From the discussion, the project team develops a few key goals that integrate the various functions of the project team and focus the team on priorities.

The following are some examples of goals during the conceptual phase:

- Developing a list of the procurement long-lead items and defining critical date
- Developing a human resources plan that identifies critical position
- Developing and building agreements with the client on the project scope of work.

Each of these goals is measurable and has a time frame specified. They can be developed as positive motivators and will take the project leaders and most of the project team to accomplish. They develop a general understanding of the priorities and are easy to remember.

Management meetings are a combination of left-brain thinking, which is fact-based, and right-brain thinking, which is creative and innovative. Using the Myers-Briggs terminology, team members who prefer feeling over thinking and perceiving over judging can contribute ideas and perspectives on the project that the more fact-oriented members might miss.

The project manager allows and encourages conversation in developing and evaluating the goals but focuses the discussion on the goals and obstacles. Management meetings take on a different focus during the month. Meetings at the beginning of the month spend time addressing the progress and potential barriers to the goals developed the previous month. During the middle of the month, the project manager leads the team in developing next month's goals as the team also works on the current month's goals. Toward the end of the month, as the goals for the month are accomplished, the meeting focuses more on the next month, enabling the team to remain goal-focused during the life of the project.

Management meetings are also an opportunity to discover obstacles to goal achievement. The project team reallocates resources or develops alternative methods for accomplishing the goals. As the project team discusses the progress of project goals, the project manager explores possible obstacles and encourages exposing potential problems in achieving goals. The project manager focuses the team on finding solutions and avoids searching for blame.

The project manager uses a facilitation leadership approach, encouraging the management team to contribute their ideas and build consensus on what goals will bring the appropriate focus. The project manager keeps the focus on developing the goals, tracking progress, identifying barriers, and making adjustments to accomplish the management goals. Although there are typically meetings for scheduling and procurement and other meetings where goals are established and problems solved, the management meeting and the goal development process create alignment among the project leadership on the items critical to the project's success.

Leadership Meetings

Leadership meetings are held less frequently and are longer in length. These meetings are used by the project manager to reflect on the project, explore the larger issues of the project, and back away from the day-to-day problem-solving. The project manager will create a safe environment for sharing thoughts and evaluations of issues that are less data-oriented. This is a right-brained, creative meeting that focuses on the people issues of the project: the relationship with the client, vendors, and project team. Team members who

favor feeling, perceiving, and intuition often contribute valuable insights in this type of meeting. The team might also share perceptions by upper management and perceptions of the community in which the project is being executed. Where the time frame for action item meetings is in weeks, and management meetings is in months, the time frame for leadership meetings is longer and takes in the entire length and impact of the project.

The project manager's meeting management skill includes creating the right meeting atmosphere for the team discussion that is needed. For discussions based on data and facts, the project manager creates the action item type meeting. The conversation is focused on sharing information and clarification. The conversation for leadership meetings is the opposite. Discussion is more open-ended and focused on creativity and innovation. Because each type of meeting requires a different meeting atmosphere, mixing the purposes of a meeting will make it difficult for the project manager to develop and maintain the appropriate kind of conversation.

Skilled project managers know what type of meeting is needed and how to develop an atmosphere to support the meeting type. Meetings of the action item type are focused on information sharing with little discussion. They require efficient communication of plans, progress, and other information team members need to plan and execute daily work. Management-type meetings are focused on developing and progressing goals. Leadership meetings are more reflective and focused on the project's mission and culture.

These three types of meetings do not cover all types of project meetings. Specific problem-solving, vendor evaluation, and scheduling meetings are examples of typical project meetings. Understanding what kinds of meetings are needed on the project and creating the right focus for each meeting type is a critical project management skill.

2.10. Key Terms

Key Terms

- **Action item meetings** are short meetings to develop a common understanding of what the short-term priorities are for the project, individual roles, and expectations for specific activities.
- **Cross-functional teams** address issues and work processes that include two or more of the functional teams.
- **Functional Requirements:** Describe the characteristics of the final deliverable in ordinary non-technical language. Functional requirements are what you want the deliverable to do.
- **Functional team** refers to the team approach related to the project functions.
- **Leadership meetings** are used by the project manager to reflect on the project, explore the larger issues of the project, and back away from the day-to-day problem-solving.
- **Management meetings** are longer and are focused on planning.
- **Non-Functional Requirements:** Specify criteria that can be used to judge the final product or service that your project delivers.
- **Problem-solving teams** are assigned to address specific issues that arise during the life of the project.
- **Project Charter:** A statement of the scope, objectives, and participants in a project.
- **Project culture** represents the shared norms, beliefs, values, and assumptions of the project team.
- **Project Scope Planning:** The overall goal of a project.
- **Scope Creep:** Change in the scope of a project that goes unmanaged. Is common in projects that have lots of stakeholders with differing goals.
- **Scope Evolution:** Refers to changes that all stakeholders agree on, and that are accompanied by corresponding changes in budget and schedule. Scope evolution is a natural result of the kind of learning that goes on as a project unfolds.
- **Scope Statement:** The document that defines the project's scope, is generally developed during the initiation phase.
- **SMART:** An acronym for Specific, Measurable, Assignable, Realistic, and Time-Related. This acronym is typically used to describe criteria for setting attainable goals in a project.
- **Weighted decision matrix:** An array that weighs certain options against criteria set forth by the group making a decision. Each criteria has a different value when compared to other criteria in the decision-making process.

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meetings, management meetings, leadership meetings, functional teams, cross-functional teams, and problem-solving teasm.

CHAPTER 3 PROJECT MANAGEMENT - THE PLANNING PHASE

Chapter Overview

3.1. Chapter Introduction

Learning Objectives

By the end of this chapter, you should be able to:

1. Define terms related to scheduling.
2. Identify the difference between a deliverable and a work package.
3. Describe the WBS numbering system.
4. Explain a variety of estimation methods.
5. Explain concepts related to the critical path method, including schedule compression.
6. Define basic terms such as budget, estimate, price, cost, and value.
7. Explain basic concepts related to budgeting.
8. Explain the benefits of a contingency plan.
9. Identify types of communications.
10. Recognize the importance of communication for project success.
11. Discuss the unique challenges of virtual teams.

3.2. Defining Activities

The **activity** definition process is a further breakdown of the work package elements of the work breakdown structures (WBS). It documents the specific activities needed to fulfill the deliverables detailed in the WBS. These activities are not the deliverables themselves but the individual units of work that must be completed to fulfill the deliverables. Activity definition uses everything we already know about the project to divide the work into activities that can be estimated. You might want to look at all the lessons learned from similar projects your company has done to get a good idea of what you need to do on the current one.

Expert judgment in the form of project team members with prior experience developing project scope statements and WBS can help you define activities. If you are asked to manage a project in a new domain, you might also use experts in that particular field to help define tasks so you can understand what activities are going to be involved. You may want to create an activity list and then have the expert review it and suggest changes. Alternatively, you could involve the expert from the very beginning and ask to have an activity definition conversation with him or her before even making your first draft of the list.

Sometimes you start a project without knowing a lot about the work that you'll be doing later. Rolling-wave planning lets you plan and schedule only the portion that you know enough about to plan well. When you don't know enough about a project, you can use placeholders for the unknown portions until you know more. These are extra items that are put at high levels in the WBS to allow you to plan for the unknown.

3.3. Scheduling Terms

Making sure all stakeholders use the same terminology is crucial in all phases of project management, but it's especially important when you are trying to get a group of diverse people to agree to a schedule. After all, a schedule only works as a form of communication if it is written in a language everyone understands. And since contract terms are often tied to a schedule, a lack of common agreement on the meaning of specific terms in a schedule can have far-ranging effects.

Terminology is so important that many state governments around the United States publish their own project management glossaries. As you embark on a new project, you'd be wise to find out if the organization you work for or the vendors you will be working with have compiled such a glossary. If such organizational resources exist, use them as a starting point for your own project glossary. Otherwise, you can always turn to the Project Management Institute's lexicon (available here: "PMI Lexicon of Project Management Terms") or glossaries provided online by consulting firms or other project management resources such as the following:

Project Management Terms

- "Project Management Glossary of Terms"(PDF)
- "Project Management Glossary"

The following definitions of scheduling-related terms are taken from a variety of sources.

- *Milestone:* "A significant event in the project; usually completion of a major deliverable" (State of Michigan: Department of Technology, Management & Budget, 2013, p. 13). An important distinction is that a milestone is a zero-duration activity; e.g., "acceptance of software by client" is a milestone preceded by many contributing activities.
- *Activity*: "An element of work performed during the course of a project. An activity normally has an expected duration, an expected cost, and expected resource requirements" (Project-Management.com, 2016). Beware that some organizations subdivide activities into tasks while others use task and activity synonymously.
- *Duration*: "The amount of time to complete a specific task given other commitments, work, vacations, etc., Usually expressed as workdays or workweeks" (State of Michigan: Department of Technology, Management & Budget, 2013, p. 9).
- *Resource:* "Any personnel, material, or equipment required for the performance of an activity" (Project-Management.com, 2016).
- *Cost:* "An expenditure, usually of money, for purchasing goods or services" (Law, 2016).
- *Slack:* "Calculated time span during which an event has to occur within the logical and imposed constraints of the network, without affecting the total project duration" (Project-Management.com, 2016). Put more simply, slack, also called float, is the amount of time that a task can be delayed without causing a delay to subsequent tasks or the project's overall completion date.

3.4. Work Breakdown Structures

The **work breakdown structure (WBS)** is a hierarchical outline of all the deliverables involved in completing a project. The WBS is part of a project scope statement. The creation of a WBS is one of the first steps in organizing and scheduling the work for a project.

The WBS is a breakdown of a project into sub-deliverables and, eventually, work packages. Each level of the WBS represents more detailed information about a project. Figure 3.1 shows how the project is broken down into major deliverables and then into sub-deliverables and work packages.

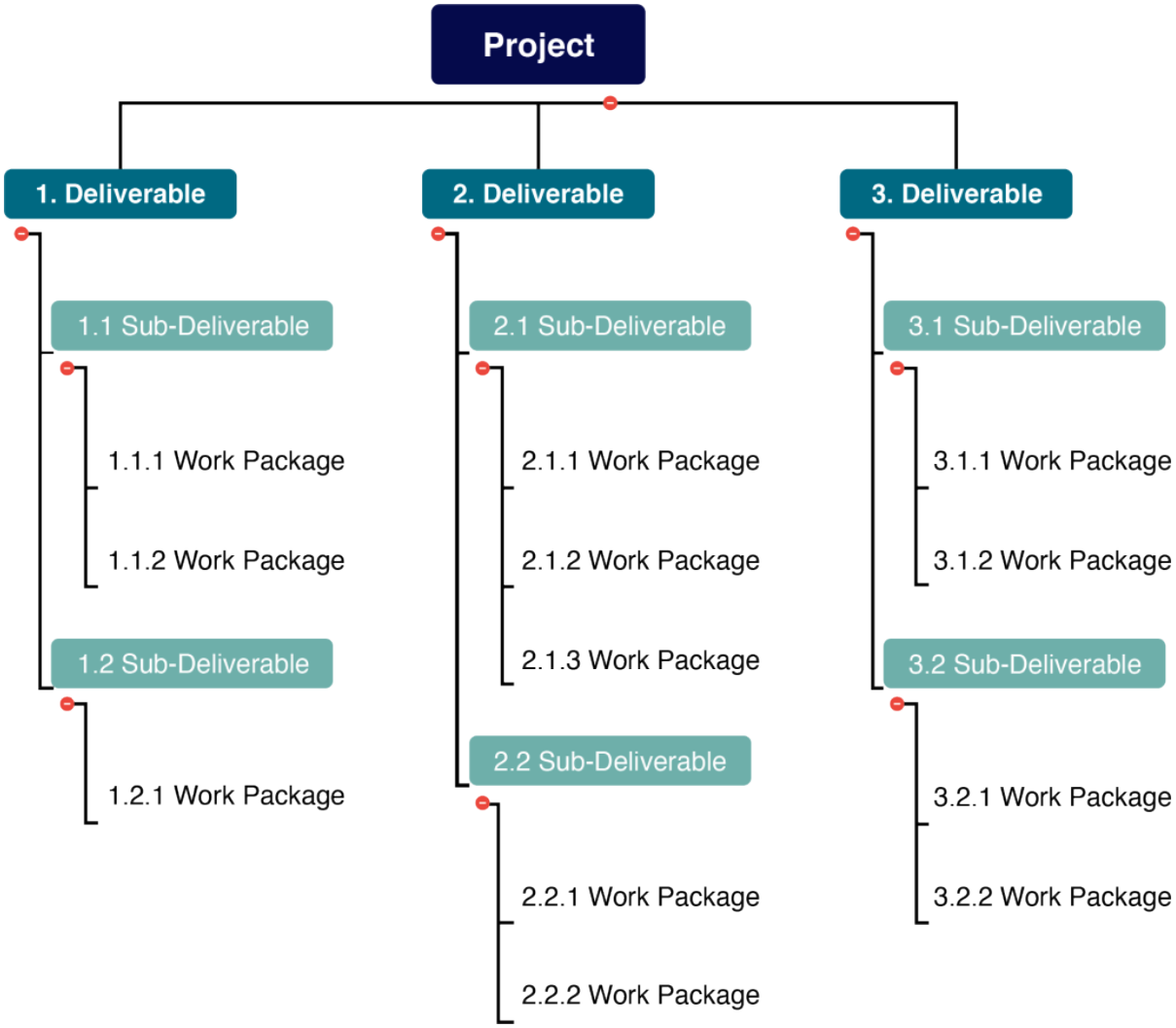

Figure 3.1: The WBS is an outline that shows how the deliverables, sub-deliverables and work packages relate to the final project.

Deliverables vs. Work Packages

Deliverables and sub-deliverables are things such as physical objects, software code, or events. In a WBS, deliverables and sub-deliverables are represented by nouns (see Figure 3.2). Work packages are assignable

units of work that will be performed to create the related deliverable. A work package can be assigned to one particular project team member, one outside contractor, or another team. The work packages may be further broken down into activities or tasks by the project team or the experts who will perform that work (see WBS dictionary later in this section).

Work packages are action-oriented and will be represented by phrases containing verbs (see Figure 3.2). The cost of a deliverable is the sum of all of its related sub-deliverables.

In Figure 3.2, the cost of the Walls deliverable is the sum of the Stud Walls and the Electrical sub-deliverables ($17,740 + $3,680 = $21,420). Likewise, the cost of a sub-deliverable is a summary of all of the work packages that must be completed to complete the sub-deliverable.

In Figure 3.2, the cost and duration of the Stud Walls deliverable is a sum of all the related work packages ($3,840 + $1,340 + $2,000 +$10,560 = $17,740; 24hrs + 8hrs + 24hrs + 32hrs = 88hrs).

Since the WBS provides a natural way to summarize (or "rollup") the costs and labour involved for various sub-deliverables, it also provides the project team with the information needed to determine whether some deliverables would be better performed by an outside specialist who could deliver the item or service more cost-effectively.

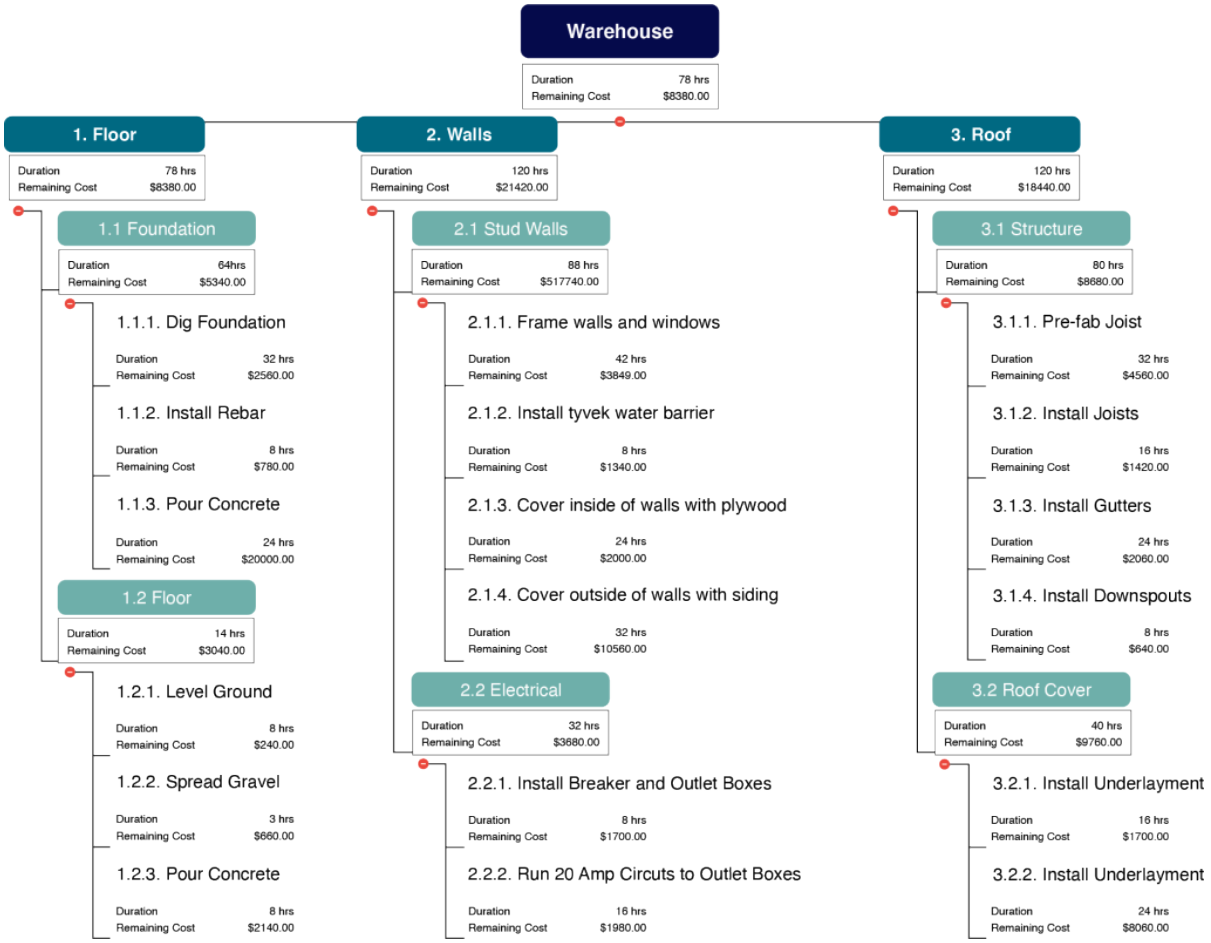

Figure 3.2: WBS for New Warehouse Project

In the example in Figure 3.2, if the project manager can find a roofing contractor that completes the roof in

less than 15 days (120 hours) and for less than $18,440, then it would be better to outsource that part of the project.

Note that work packages are independent of each other in a WBS, and do not summarize or include the work from other work packages. Work packages are the lowest level of the WBS.

WBS Numbering

Project managers use the WBS during project execution to track the status of deliverables and work packages. The items in a WBS are numbered so it is easy to understand the deliverable, or sub-deliverable, to which any particular work package is related. Notice that in Figure 3.2, the Install Metal Roof item is numbered 3.2.2, so it is easy to see that this work package is related to the third major deliverable (Roof: 3.) and the second sub-deliverable (Roof Cover: 3.2.) and that it is also the second work package for the creation of the roof covering (3.2.2).

This numbering system allows for easy reference and filtering. For example, an electrician working on the Warehouse project only needs to receive details and updates that are related to work packages that start with 2.2 (the Electrical sub-deliverable).

Decomposition

Decomposition is the process used to break the project scope of work into the deliverables, sub-deliverables, and work packages involved in completing the project.

The process of decomposition begins with identifying the highest-level deliverables. These deliverables are then broken into sub-deliverables. Many layers of sub-deliverables may be needed for a project. A general rule of thumb is that if the WBS has more than 5 layers of sub-deliverables, the project team should reassess and try to simplify the WBS structure (often by changing the way higher-level deliverables are grouped and broken down).

Once the lowest level of deliverables has been reached, the next step is to break the sub-deliverables into work packages. The work packages describe the work that needs to be done to create the sub-deliverable. Remember that work packages typically contain verbs and can be assigned to a person, team or contractor.

Once the project team has drafted the WBS, they should ask themselves: ” If all the work packages were completed, and all the deliverables in this WBS were delivered, would the project be complete?” If the answer is no, then pieces of the WBS are still missing. If the answer is yes, then the project team can move on to creating the WBS dictionary, getting bottom-up estimates on time and resource requirements, and planning how to schedule the work.

The WBS Dictionary

The WBS dictionary provides detailed documentation about each work package, including;

- Who is responsible for completing the work package?
- What resources will be needed to complete the work package?
- What deliverable(s) is the work package contributing to?
- What deadlines or milestones are associated with this work package?
- What are the acceptance criteria for this work package?

When the WBS is created, not all of the information about the work packages is known (for example, the estimates for labour and material costs). Remember from Chapter One that the planning process continues throughout the execution of the project. As a result, the WBS dictionary is a "living document" that will be augmented, edited and updated as the project moves forward. figure 3.3 is an example of a WBS Dictionary entry; note that several items will be added later in the planning process.

Hammer and Chisel Incorporation WBS Dictionary											
Item Number	Description	Constraints	Responsible	Milestone	Schedule	Resources	Cost	Quality	Acceptance Criteria	References	Guidelines
1.1											
1.1.1											
1.1.2											
1.1.3											

Figure 3.3 Hammer and Chisel Incorporation WBS Dictionary Example.

3.5. Time Estimation

Estimates have a huge influence on a project and are a large source of project risk. Watch the video on time estimates to learn about how estimates are used for project planning.

Video: Time Estimates by Prof C [3:04] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

Top-down estimation	Also referred to as macro, estimation methods are used to determine if a project is feasible, to calculate funding requirements, and to determine the resources needed to complete a project. These methods are not extremely accurate but provide a relatively fast way to estimate the time and costs required for a project.
Bottom-up estimation	Also referred to as micro, estimation methods are used to provide a detailed and more accurate estimate and are usually derived from the detailed list of work packages or activities found in the work breakdown structure.

As the video mentions, all estimates contain risk. If estimates are too low, then a project will take more time and money to complete than what was budgeted—obviously, a bad situation. If estimates are too high, then a project will take less time and money than originally estimated. This might seem to be a desirable situation, but good project managers will realize that estimates that are too high will cause an organization to over-allocate resources to a project, thereby preventing other projects from being pursued due to organizational resource shortages. Therefore, it is important to have the most accurate estimates possible. The project team needs to understand the value of accurate estimates and avoid the natural human tendency to pad estimates. Once unbiased estimates for a project have been generated, the project manager can calculate what time buffers and budgetary reserves should be added to the project plan to deal with uncertainty.

Accuracy of Estimates

Prior to project authorization, estimates for project cost need to be given, but these estimates can be rough estimates. More definitive estimates will be needed as the project progresses and can be generated.

PMI defines the following ranges for estimates:

- Rough Order of Magnitude (ROM). ROM estimates are made at the initiation of the project and can be +/- 50 percent of the actual or final cost.
- Budget Estimate. Budget estimates are used in project planning and can be within a range from -10 to +25 percent of the actual or final cost.
- Definitive Estimate. Definitive estimates are generated as the project progresses, and the variability of the estimate is reduced (see Figure 3.4). Definitive estimates are within a range from -5 to +10 percent of the actual or final cost.

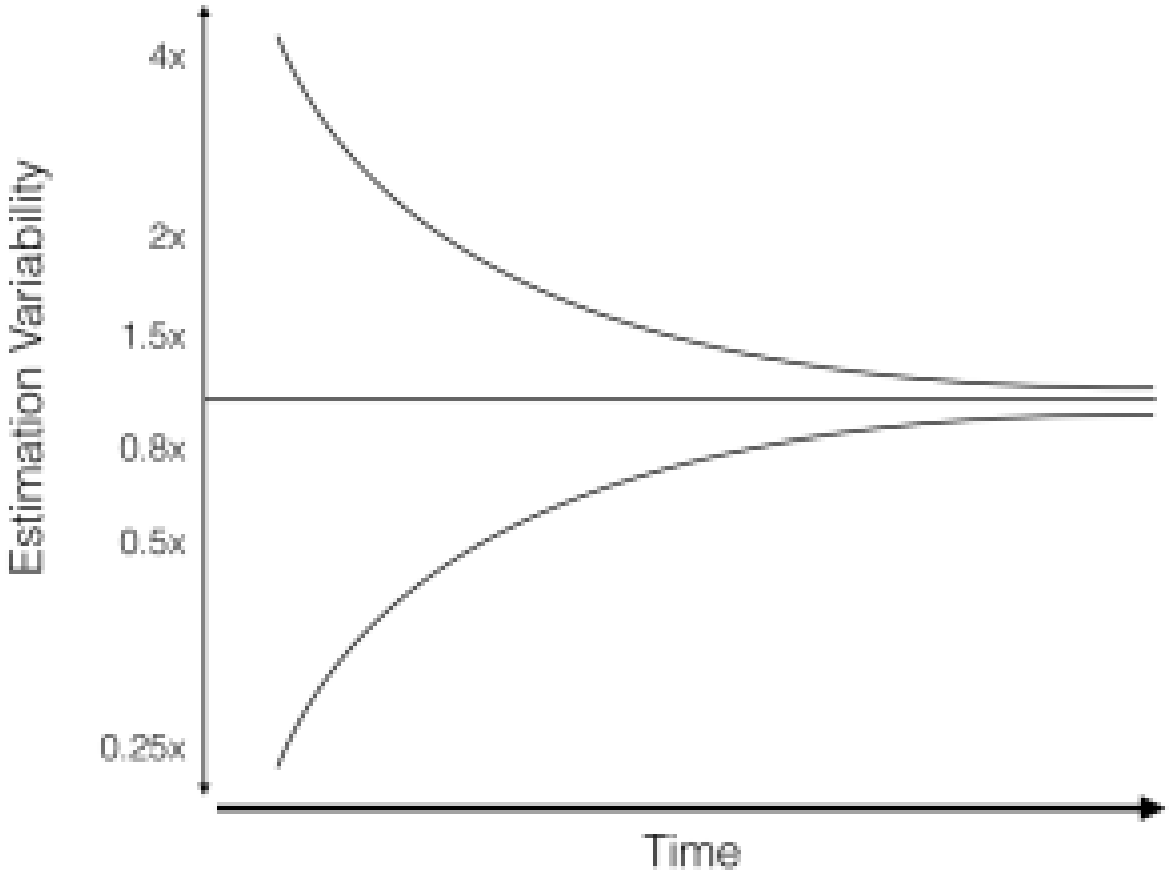

Figure 3.4: Estimates contain a high degree of variability at the inception of a project, and that variability decreases as the project is defined and moves toward completion.

Top Down (Macro) Estimation

Top-down, or macro, estimation methods allow for a quick estimate of project costs based on historical information.

Analogous Estimating

Analogous estimating uses information from a previous project to estimate the cost of completing a similar project in the future. This provides a quick estimate but should be used with caution. Analogous estimating only works when comparing projects that are similar in scope and will be completed in similar conditions.

For example, a small IT business developed a website for a local restaurant for which they charged $4000. Another restaurant approached the IT firm and asked for a rough cost estimate for a similar site. The IT firm can tell the second restaurant that such work will cost approximately $4000. Of course, the caveat is that this second website will have a similar number of pages, functions, and graphics as the first site.

The advantage of analogous estimating is that it allows for a very quick estimate to be provided for a customer. If in the example above, the second restaurant had only budgeted $200 for a website, they would have quickly determined that they have not budgeted enough, and the IT firm would be able to quickly determine that this

is not a serious customer. However, if the second restaurant is okay with this approximate price, the IT firm can work with the restauranteur to develop a detailed cost proposal.

Analogous estimating is not accurate if:

- The projects differ in scope.
- There is a difference in the conditions under which the work will be performed.
- There is a difference in the cost of resources (materials, labour).

Learning Curves

Projects that require an activity to be repeated several times throughout the project will benefit from a so-called learning curve. Learning curves, also known as improvement curves or experience curves, are important when labour is one of our main resources.

Consider a large construction project for a new highway. The first hundred feet of highway may be fairly slow to complete. However, as workers become more experienced and figure out better ways to organize their work, the time required to construct the next one hundred feet of new highway will be less.

Learning curves were first observed in aircraft production and are also used heavily in operations management. Each time production doubles, a learning rate can be calculated. See Table 3.1 for the calculation of a learning curve. When output doubles, from the first screen installed to the second, a learning rate is calculated. Another learning rate is calculated when the output doubles from the second screen installed to the fourth, and so on. The average learning curve can then be calculated. Later, if this company is contracted to install projector screens as part of a project, they can use this learning curve in their labour estimates.

There is a limit to the improvement of a learning curve. Eventually, the learning curve will “bottom out,” and no more improvement gains can be achieved.

Table 3.1

Number of screens installed	Time to install projector screen	Learning Rate
1	500	
2	440	88.0%
3	420	
4	400	90.9%
5	390	
6	380	
7	370	
8	360	90.0%
9	355	
10	350	
11	345	
12	344	
13	342	
14	340	
15	339	
16	338	93.9%
Average	90.7%	

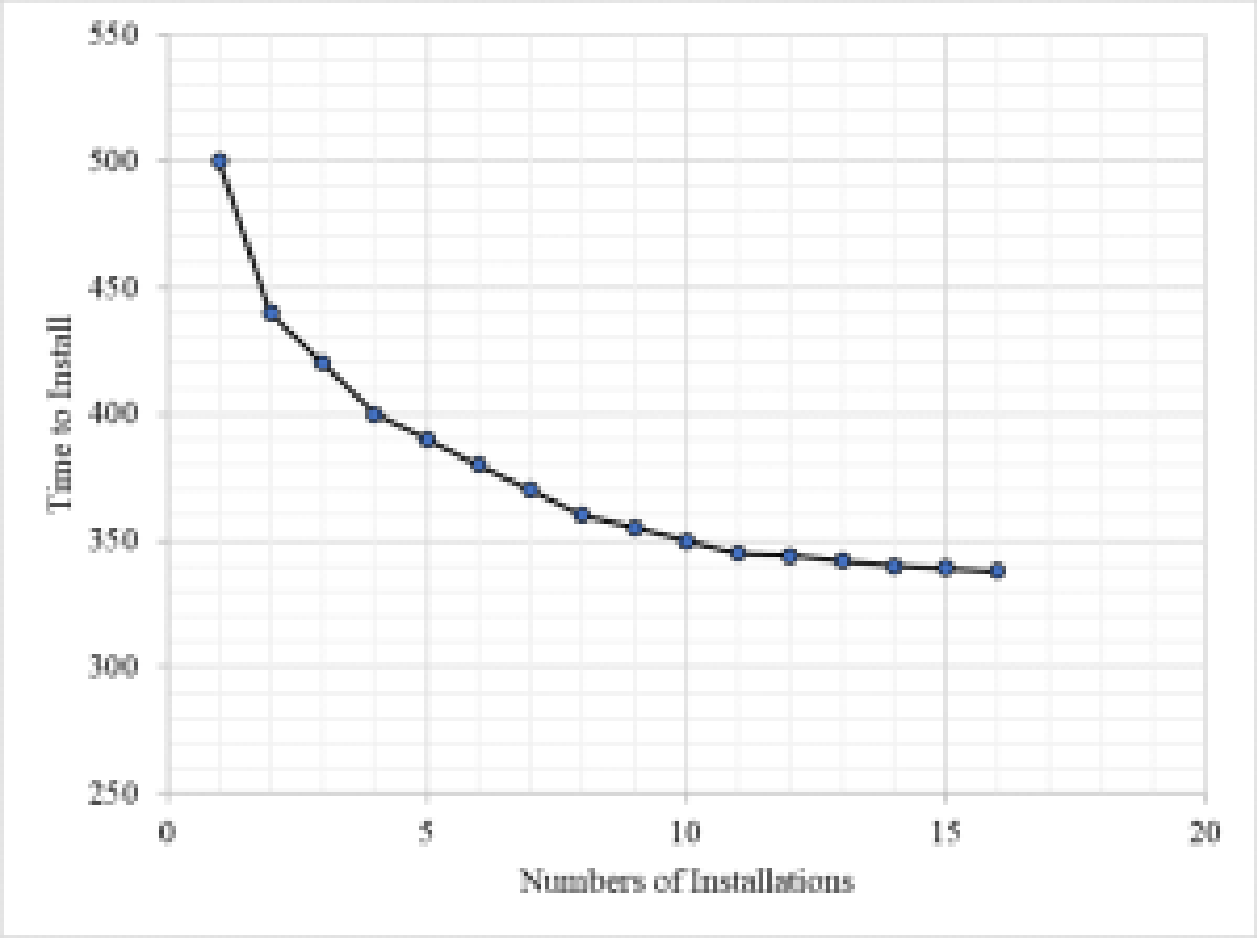

Figure 3.5: Learning curve calculation – Each time production is doubled, the learning rate for that doubling is calculated: (screen 2 time/screen 1 time), (screen 4 time/screen 2 time), (screen 8 time/screen 4 time), and (screen 16 time/screen 8 time).

However, several things can be done to extend and improve the slope of a learning curve:

- Incentivize workers to improve the processes they are using to complete their tasks. These incentives are "built-in" for employee-owned companies, where employees share in the reward if profits increase.
- Make investments in new technology and equipment.
- Invest in training and education for new workers so they are not "learning on the job."
- Give workers the flexibility to make changes to how materials are sourced, delivered, and organized.
- Re-engineer the deliverables so they are easier to produce.

Learning curves usually hold if the work is continuous. If there is a break in the work, gains in productivity when work resumes will not be as great as if the work had continued uninterrupted.

Bottom Up (Micro) Estimation

Bottom-up or micro means breaking down complex activities into pieces and working out the resource assignments for each piece. It is a process of estimating individual activity resource needs or costs and then adding these up together to come up with a total estimate. Bottom-up estimating is a very accurate means of

estimating, provided the estimates at the scheduled activity level are accurate. However, it takes a considerable amount of time to perform bottom-up estimating because every activity must be assessed and estimated accurately to be included in the bottom-up calculation—the smaller and more detailed the activity, the greater the accuracy and cost of this technique.

The Bottom-up estimation techniques are used when the project is approved or is very likely to be approved. Bottom-up estimation techniques generate estimates for individual work packages or sub-deliverables, which are then summarized to reflect total costs. Bottom-up estimates are more accurate and detailed and take more time to generate. Instead of relying on historical information, bottom-up estimates rely on people with experience who can provide time and cost estimates for a particular work package or sub-deliverable.

These basic guidelines should be followed when generating bottom-up estimates:

- Have people familiar with the work make the estimate.
- If possible, use several people to make estimates.
- Estimates should be based on normal conditions and a normal level of resources.
- Estimates should not make allowances for contingencies.

After estimates are collected and analyzed, the project manager or team will add buffer times and contingency funds to the project.

Parametric Estimating

Parametric estimates, also called the ratio method, use historical information or industry benchmarks as the basis for making an estimate. Parametric estimates are made by multiplying the size of a project by an established cost per unit.

Table 3.2: Hospital construction costs – Data from Reed Construction 2014.

Cost Estimate (Union Labour)	**Cost per Square Foot**
Labour and Materials	$234.09
Contractor Fees (GC, Overhead, Profit)	$58.52
Architectural Fees	$26.34
Total Building Cost (per Square foot)	**$318.95**
Cost Estimate (Open Shop)	**Cost per Square Foot**
Labour and Materials	$217.51
Contractor Fees (GC, Overhead, Profit)	$54.38
Architectural Fees	$24.47
Total Building Cost (per Square foot)	**$296.36**

For example, industry data is available for the per-square-foot construction cost for many types of buildings. An architect can use this information to make a parametric estimate by multiplying the cost per square foot by the size of any new building being considered. If an organization wants to build a new hospital using union labour, a rough estimate of the construction cost can be calculated using the information in Table 3.2: 20,000 ft^2 clinic × $318.95/$ft^2$ = $6,379,000. The organization can then use this estimate as an approximate cost and start securing the money for the project. Once the funding is secured, an architect can develop a complete plan and produce a more accurate project budget using a bottom-up estimation method.

Single Point Estimate

Single point estimation is an estimate obtained from just one estimator. This can work well with experienced estimators and work packages that are straightforward. Single-point estimates are quick to generate and summarize in a project plan. The risk with single-point estimates is that the estimator will overlook some aspects of the work and inadvertently provide an inaccurate estimate.

Three-points estimate

Instead of asking an estimator for just one estimate, a three-point estimate asks the estimator to provide three-time estimates for each activity:

- An optimistic time estimate (if all goes well, what is the shortest time period one could realistically expect for the completion of this activity?). This will be designated in calculations as ***a***.
- The most likely time estimate (if all goes normally, what is the average time one would expect it would take for an activity to be completed?). This will be designated in calculations as ***m***.
- A pessimistic time estimate (if work goes poorly, what is the longest time period one could realistically expect for the completion of this activity). This will be designated in calculations as ***b***.

These three estimates can be used as inputs to calculate an estimated time for the activity or work package to be completed, either through a simple average or through a weighted average known as **T_e,** where **T_e=(a+4m+b)÷6.**

Resource Levelling

Resource levelling is used to examine the unbalanced use of resources (usually people or equipment) over time and for resolving over-allocations or conflicts.

When performing project planning activities, the manager will attempt to schedule certain tasks simultaneously. When more resources, such as machines or people, are needed than are available, or perhaps a specific person is needed in two tasks, the tasks will have to be rescheduled sequentially to manage the constraint. Resource levelling during project planning is the process of resolving these conflicts. It can also be used to balance the workload of primary resources over the course of the project, usually at the expense of one of the traditional triple constraints (time, cost, scope).

When using specially designed project software, levelling typically means resolving conflicts or over-allocations in the project plan by allowing the software to calculate delays and update tasks automatically. Project management software levelling requires delaying tasks until resources are available. In more complex environments, resources could be allocated across multiple concurrent projects, thus requiring the process of resource levelling to be performed at the company level.

In either definition, levelling could result in a later project finish date if the tasks affected are in the critical path.

3.6. Managing the Schedule

The Gantt Chart

A **Gantt chart** is a type of bar chart developed by Henry Gantt that illustrates a project schedule. Gantt charts are easy to read and are commonly used to display scheduled activities. These charts display the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project. Some Gantt charts also show the dependency relationships (i.e., precedence network) between activities.

Gantt charts show all the key stages of a project and their duration as a bar chart, with the time scale across the top. The key stages are placed on the bar chart in sequence, starting in the top left corner and ending in the bottom right corner (Figure 3.6). A Gantt chart can be drawn quickly and easily and is often the first tool a project manager uses to provide a rough estimate of the time that it will take to complete the key tasks. Sometimes it is useful to start with the target deadline for completion of the whole project because it is soon apparent if the time scale is too short or unnecessarily long. Thus, the detailed Gantt chart is usually constructed after the main objectives have been determined.

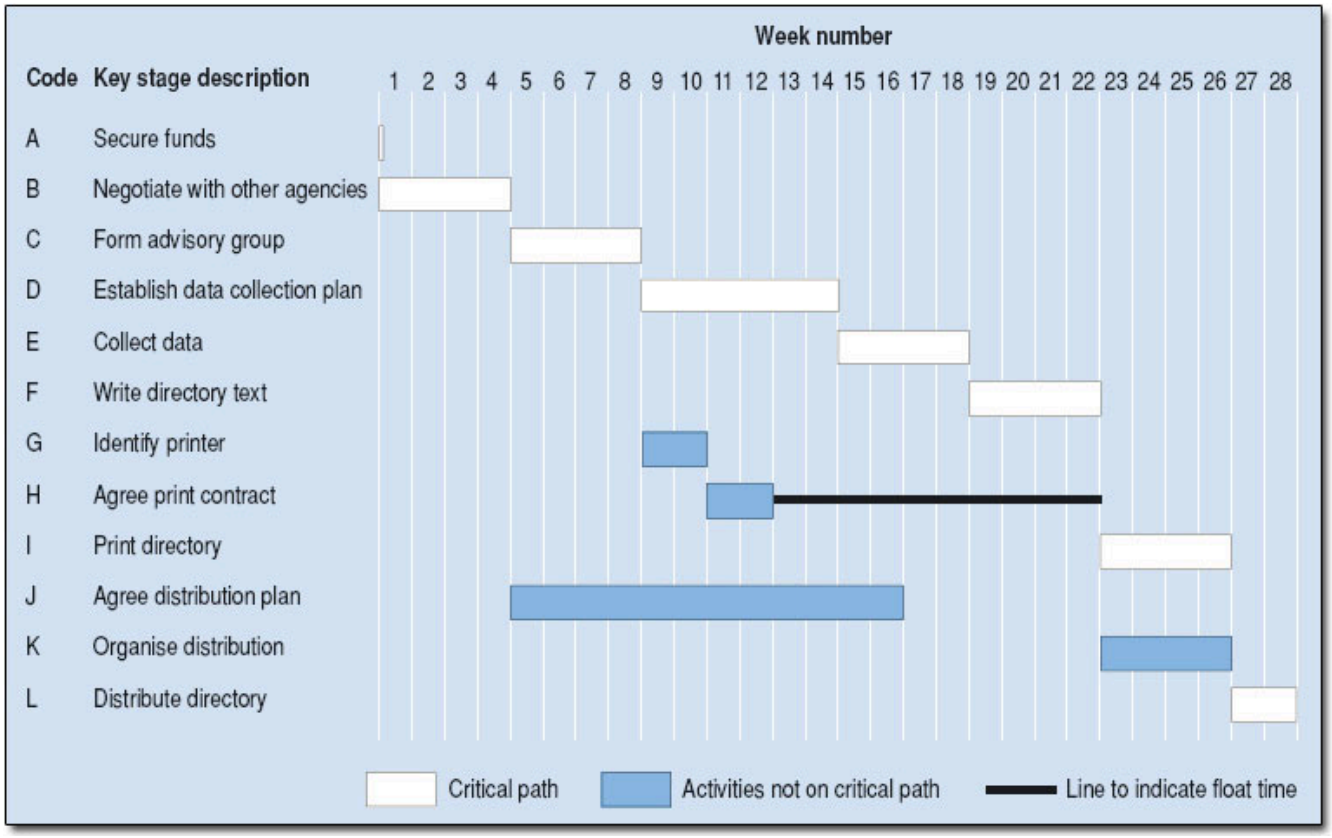

Figure 3.6: Gantt chart for directory production.

Network Diagram

Many project managers use network diagrams when scheduling a project. The **network diagram** is a way to

visualize the interrelationships of project activities. Network diagrams provide a graphical view of the tasks and how they relate to one another. The tasks in the network are the work packages of the WBS. All of the WBS tasks must be included in the network because they have to be accounted for in the schedule. Leaving even one task out of the network could change the overall schedule duration, estimated costs, and resource allocation commitments.

The first step in creating a network diagram is to arrange the tasks from your WBS into a sequence. Some tasks can be accomplished at any time throughout the project, whereas other tasks depend on input from another task or are constrained by time or resources.

The WBS is not a schedule, but it is the basis for one. The network diagram is a schedule but is used primarily to identify key scheduling information that ultimately goes into user-friendly schedule formats, such as milestone and Gantt charts.

The network diagram provides important information to the project team. It provides information about how the tasks are related (Figure 3.7), where the risk points are in the schedule, how long it will take as currently planned to finish the project, and when each task needs to begin and end.

All network diagrams have the advantages of showing task interdependencies, start and end times, and the critical path (the longest path through the network) but the AOA network diagram has some disadvantages that limit the use of the method.

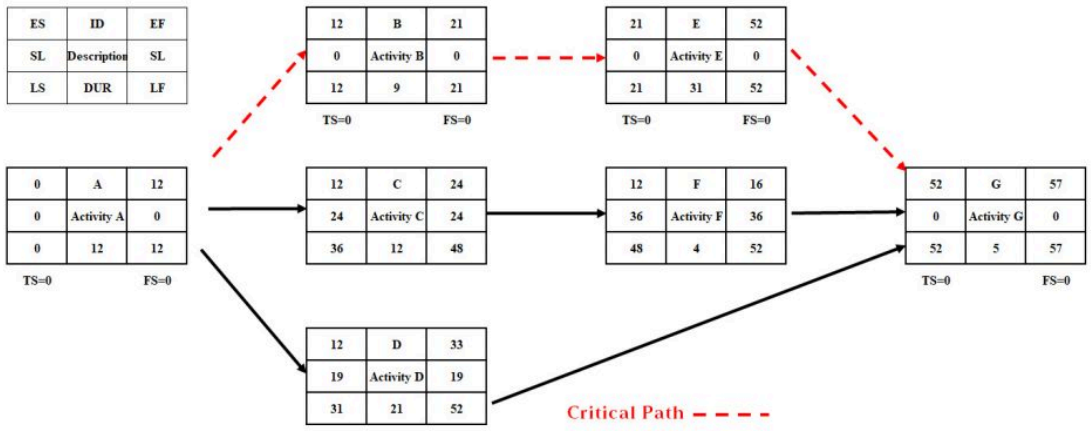

Figure 3.7: An example of an activity on node (AON) diagram

Forward and Backward Pass

Once a network diagram has been made and estimated activity durations have been assigned to each activity, the following attributes of each activity can be calculated:

- Early start time (ES)
- Late start time (LS)
- Early finish time (EF)
- Late finish time (LF)
- Slack or float (SL or FL)

These activity attributes are calculated using two processes: the forward pass and the backward pass.

> Watch the video *Project Management Networks Part 2: Forward and Backward Pass* to learn how to make these calculations.
>
> Video: Project Management Networks Part 2: Forward and Backward Pass by Prof C [7:08] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

The forward and backward passes are also used to fully calculate the critical path(s) in a project. Note: there can be instances where the start of an activity is on the critical path, but the finish is not on the critical path. This is unusual but can happen depending on the types of relationships that are involved.

The Critical Path

The critical path (dashed red line as seen in figure 3.7) describes the sequence of tasks that would enable the project to be completed in the shortest possible time. It is based on the idea that some tasks must be completed before others can begin. A critical path diagram is a useful tool for scheduling dependencies and controlling a project. In order to identify the critical path, the length of time that each task will take must be calculated.

Milestones

One way to avoid getting lost in a sea of details is to focus on your project's milestones, which can serve as a high-level guide. You can use pull planning to identify your project's milestones and then use the critical path to figure out how to hit those milestones. It gives a reality test to determine whether your milestones are, in fact, achievable. Then you're off and running, in living order.

In an excellent blog post on the usefulness of milestones, Elizabeth Harrin (2017) explains that milestones should be used "as a way of showing forward movement and progress and also show people what is going on, even if they don't have a detailed knowledge of the tasks involved to get there. In that respect, they are very useful for stakeholder communication and setting expectations" (Harrin, 2017). You can use milestones, she explains, to track your progress, focus on:

- starting of significant phases of work
- ending of significant phases of work
- marking the deadline for something
- showing when an important decision is being made. (Harrin, 2017)

Milestones are especially useful as a form of communication on the health of a project. A version of a project schedule that consists only of milestones allows stakeholders to get a quick sense of where things stand. You may want to report on milestones in the project's dashboard, which should serve as an at-a-glance update for the project.

3.7. Resource Estimation

Resources are people, equipment, places, money, or anything else that you need in order to do all of the activities that you planned for. Every activity in your activity list needs to have resources assigned to it. Before you can assign resources to your project, you need to know their availability. Resource availability includes information about what resources you can use on your project when they're available to you and the conditions of their availability. Don't forget that some resources, like consultants or training rooms, have to be scheduled in advance, and they might only be available at certain times. You'll need to know this before you can finish planning your project. If you are starting to plan in January, a June wedding is harder to plan than one in December because the wedding halls are all booked up in advance. That is clearly a resource constraint. You'll also need the activity list that you created earlier, and you'll need to know how your organization typically handles resources. You're set for resource estimation once you've got a handle on these things.

Activity resource estimating aims to assign resources to each activity in the activity list. There are four tools and techniques for estimating activity resources.

1. *Expert judgment means* bringing in experts who have done this sort of work before and getting their opinions on what resources are needed.
2. *Alternative analysis* means considering several different options for how you assign resources. This includes varying the number of resources as well as the kind of resources you use. Many times, there's more than one way to accomplish an activity, and alternative analysis helps decide among the possibilities.
3. *Published estimating data* is something that project managers in a lot of industries use to help them figure out how many resources they need. They rely on articles, books, journals, and periodicals that collect, analyze, and publish data from other people's projects.
4. *Project management software* such as Microsoft Project will often have features designed to help project managers estimate resource needs and constraints and find the best combination of assignments for the project.

Resource Management

Resource management is the efficient and effective deployment of an organization's resources when they are needed. Such resources may include financial resources, inventory, human skills, production resources, or information technology (IT). In the realm of project management, processes, techniques, and philosophies for the best approach to allocating resources have been developed. These include discussions on functional versus cross-functional resource allocation as well as processes espoused by organizations like the Project Management Institute (PMI) through the methodology of project management outlined in their publication A Guide to the Project Management Body of Knowledge (PMBOK). Resource management is a key element in activity resource estimating and project human resource management. As is the case with the larger discipline of project management, there are resource management software tools available that automate and assist the process of resource allocation to projects.

Human Resources Management

The most important resource to a project is its people—the project team. Projects require specific expertise at specific moments in the schedule, depending on the milestones being delivered or the given phase of the project. An organization can host several strategic projects concurrently over the course of a budget year, which means that its employees can work on more than one project at a time. Alternatively, an employee may

be seconded away from his or her role within an organization to become part of a project team because of a particular expertise. Moreover, projects often require talent and resources that can only be acquired via contract work and third-party vendors. Procuring and coordinating these human resources, in tandem with managing the time aspect of the project, is critical to overall success.

Techniques for Managing Resources

One resource management technique is **resource levelling**. It aims to smooth out the stock of resources on hand and reduce both excess inventories and shortages. The required data are the demands for various resources, forecast by time period into the future as far as is reasonable; the resources' configurations required in those demands; and the supply of the resources, again forecast by time period into the future as far as is reasonable. The goal is to achieve 100% utilization. However, that is very unlikely when weighted by important metrics and subject to constraints; for example, meeting a minimum quality level but otherwise minimizing cost.

3.8. Cost Estimation

Ultimately, cost, the number management typically cares about most in a for-profit organization, is determined by the price. For many projects, knowing the exact cost of an endeavour is impossible until it is completed. Stakeholders can agree on the intended value of a project at the beginning, and that value has an expected cost associated with it. But you may not be able to pin down the cost more precisely until you've done some work on the project and learned more about it.

To estimate and manage costs effectively, you need to understand the different types of costs:

- **Direct Costs:** "An expense that can be traced directly to (or identified with) a specific cost centre or cost object such as a department, process, or product" (Business Dictionary, n.d.). Examples of direct costs include labour, materials, and equipment. A direct cost changes proportionately as more work is accomplished.
- **Direct Project Overhead Costs:** Costs that are directly tied to specific resources in the organization that are being used in the project. Examples include the cost of lighting, heating, and cleaning the space where the project team works. Overhead does not vary with project work, so it is often considered a fixed cost.
- **General and Administrative (G&A) Overhead Costs**: The "indirect costs of running a business," such as IT support, accounting, and marketing" (Tracy, n.d., para. 1).

The type of contract governing your project can affect your consideration of costs. The two main types of contracts are fixed-price and cost-plus. Fixed price is the more predictable of the two with respect to the final cost, which can make such contracts appealing to the issuing party. But "this predictability may come with a price. The seller may realize the risk that he is taking by fixing a price, and so will charge more than he would for a fluid price or a price that he could negotiate with the seller on a regular basis to account for the greater risk the seller is taking" (Symes, 2018).

Many contracts include both fixed-price and cost-plus features. For example, they might have a fixed price element for those parts of the contract that have low variability and are under the direct control of the project team (e.g., direct labour) but have variable cost elements for those aspects that have a high degree of uncertainty or are outside the direct control of the project team (e.g., fuel costs or market-driven consumables).

It is important to come up with detailed estimates for all the project costs. Once this is compiled, you add up the cost estimates into a budget plan. It is now possible to track the project according to that budget while the work is ongoing.

Often, when you come into a project, there is already an expectation of how much it will cost or how much time it will take. When you make an estimate early in the project without knowing much about it, that estimate is called a rough order-of-magnitude estimate (or a ballpark estimate). This estimate will become more refined as time goes on and you learn more about the project. Here are some tools and techniques for estimating cost:

- *Determination of Resource Cost Rates:* People who will be working on the project all work at a specific rate. Any materials you use to build the project (e.g., wood or wiring) will be charged at a rate, too. Determining resource costs means figuring out the rate for labour and materials.
- *Vendor Bid Analysis:* Sometimes, you will need to work with an external contractor to get your project

done. You might even have more than one contractor bid on the job. This tool evaluates those bids and chooses the one you will accept.
- *Reserve Analysis*: You need to set aside some money for cost overruns. If you know that your project has a risk of something expensive happening, it is better to have some cash available to deal with it. Reserve analysis means putting some cash away in case of overruns.
- *Cost of Quality:* You will need to figure the cost of all your quality-related activities into the overall budget. Since it's cheaper to find bugs earlier in the project than later, there are always quality costs associated with everything your project produces. Cost of quality is just a way of tracking the cost of those activities. It is the amount of money it takes to do the project right.

Once you apply all the tools in this process, you will arrive at an estimate for how much your project will cost. It's important to keep all of your supporting estimate information. That way, you know the assumptions made when you were coming up with the numbers. Now you are ready to build your budget plan.

Estimating Costs to Compare and Select Projects

During the conceptual phase when project selection occurs, economic factors are an important consideration in choosing between competing projects. To compare the simple paybacks or internal rates of return between projects, an estimate of the cost of each project is made. The estimates must be accurate enough so that the comparisons are meaningful, but the amount of time and resources used to make the estimates should be appropriate to the size and complexity of the project. The methods used to estimate the cost of the project during the selection phase are generally faster and consume fewer resources than those used to create detailed estimates in later phases. They rely more on the expert judgment of experienced managers who can make accurate estimates with less detailed information. Estimates in the earliest stages of project selection are usually based on information from previous projects that can be adjusted—scaled—to match the size and complexity of the current project or developed using standardized formulas.

Analogous Estimate

An estimate that is based on other project estimates is an **analogous estimate**. If a similar project costs a certain amount, then it is reasonable to assume that the current project will cost about the same. Few projects are exactly the same size and complexity, so the estimate must be adjusted upward or downward to account for the differences. The selection of similar projects and the amount of adjustment needed are up to the person who makes the estimate. Normally, this judgment is based on many years of experience estimating projects, including incorrect estimates that were learning experiences for the expert.

Less-experienced managers who are required to make analogous estimates can look through the documentation available from previous projects. If projects were evaluated using the Darnall-Preston Complexity Index (DPCI), the manager can quickly identify projects that have profiles similar to the project under consideration, even if other people managed those projects.

The DPCI assesses project attributes, enabling better-informed decisions in creating the project profile. This index assesses the complexity level of key components of a project and produces a unique project profile. The profile indicates the project complexity level, which provides a benchmark for comparing projects and information about the characteristics of a project that can then be addressed in the project execution plan. It achieves this objective by grouping 11 attributes into four broad categories: internal, external, technological complexity, and environmental.

Comparing the original estimates with the final project costs on several previous projects with the same DPCI

ratings gives a less-experienced manager the perspective that it would take many years to acquire by trial and error. It also provides references the manager can use to justify the estimate.

Example: Analogous Estimate for John's Move

John sold his apartment and purchased another one. It is now time to plan for the move. John asked a friend for advice about the cost of his move. His friend replied, "I moved from an apartment a little smaller than yours last year, and the distance was about the same. I did it with a 14-foot truck. It costs about $575 for the truck rental, pads, hand truck, rope, boxes, and gas." Because of the similarity of the projects, John's initial estimate of the cost of the move was less than $700, so he decided that the cost would be affordable and the project could go forward.

Parametric Estimate

If the project consists of activities that are common to many other projects, average costs are available per unit. For example, if you ask a construction company how much it would cost to build a standard office building, the estimator will ask for the size of the building in square feet and the city in which the building will be built. From these two factors—size and location—the company's estimator can predict the cost of the building. Factors like size and location are parameters—measurable factors that can be used in an equation to calculate a result. The estimator knows the average cost per square foot of a typical office building and adjustments for local labour costs. Other parameters, such as the quality of finishes, are used to refine the estimate further. Estimates that are calculated by multiplying measured parameters by cost-per-unit values are parametric estimates.

Activity-Based Estimates

An activity can have costs from multiple vendors and internal costs for labour and materials. Detailed estimates from all sources can be reorganized so those costs associated with a particular activity can be grouped by adding the activity code to the detailed estimate. The detailed cost estimates can be sorted and then subtotalled by activity to determine the cost for each activity.

Table 3.3 Detailed Costs Associated With Activities

Category	Description	Activity	Quantity	Unit Price	Cost
Packing Materials	Small Boxes	2.1	10	$1.70	$17.00
Packing Materials	Medium Boxes	2.1	15	$2.35	$35.25
Packing Materials	Large Boxes	2.1	7	$3.00	$21.00
Packing Materials	Extra Large Boxes	2.1	7	$3.75	$26.25
Packing Materials	Short Hanger Boxes	2.1	3	$7.95	$23.85
Packing Materials	Box Tape	2.1	2	$3.85	$7.70
Packing Materials	Markers	2.1	2	$1.50	$3.00
Packing Materials	Mattress/Spring Bags	2.1	2	$2.95	$5.90
Packing Materials	Lift Straps Per Pair	2.1	1	$24.95	$24.95
Packing Materials	Bubble Wrap	2.1	1	$19.95	$19.95
Packing Materials	Furniture Pads	2.1	4	$7.95	$31.80
Packing Materials	Rental	2.1			$400.00
Packing Materials	Gas at 10mpg	2.1	200	$2.25	$45.00

3.9. Understanding Cost

Budgeting is an exercise in refining your focus. You start with a wide-angle estimate, in which the details are necessarily fuzzy, and bit by bit, zero in on a sharper picture of project costs. You might be temperamentally inclined to try to nail down every figure in an early draft of a budget, but in fact, you should only develop a budget at the precision needed for current decisions. Your overall precision can and should advance as the project advances.

This is especially important in the earliest stages of the budgeting process when you are working out rough estimates. Take care to estimate at the appropriate level of precision: Don't make the mistake of thinking you can estimate costs to the exact penny or dollar. $378,333.27 is not a realistic or intelligent estimate. Ultimately, overly precise budgets represent a communication failure. By proposing a budget to the customer that contains overly precise figures, you risk giving a false sense of accuracy regarding your understanding of and knowledge of the project.

When you are still working out estimates in the early stages of the budgeting process, it's helpful to include an uncertainty percentage. A typical approach is to include a +/- percentage, such as $400,000 +/- 10%. The percentage may initially be large but should gradually decrease as the project progresses, and the level of uncertainty declines. For IT projects which are notoriously difficult to estimate, consider going a step further and adding an uncertainty percentage to every line item. Some items, such as hardware, might be easy to estimate. However, other items, such as labour to create new technology, can be extremely difficult to estimate. These line item variances can significantly influence the total estimate variance in many projects.

But even when you have a final budget in hand, you need to prepare for uncertainty by including an official contingency fund, which is a percentage of the budget set aside for unforeseen costs. Contingency funds are described in more detail later in this chapter.

Successful project managers use the budgeting process as a way to create stakeholder buy-in regarding the use of available resources to achieve the intended outcome. By being as transparent as possible about costs and resource availability, you'll help build trust among stakeholders. By taking care to use the right kinds of contracts—for example, contracts that don't penalize stakeholders for escalating prices caused by a changing economy—you can create incentives that keep all stakeholders focused on delivering the project value, rather than merely trying to protect their own interests. The relationship between costs and contracts is discussed in more detail later in chapter 7.

Creating a Project Budget

This blog post by Tim Clark includes some helpful tips on creating a project budget: 7 Tips to Create a Budget for your Project.

3.10. Contingencies

In addition to creating the project plan, you need to create a **contingency plan**, which is a plan for addressing key possible obstacles to project success. A contingency plan defines alternate paths for the project in case various risks are realized.

A contingency plan typically includes a **contingency fund**, which is an amount of resources set aside to cover unanticipated costs. Contingency plans and funds are necessary because even the most seasoned project planner sometimes succumbs to excessive optimism, assuming everything will go well and that all resources will be available when needed. Also, no matter how thoroughly you plan a project, you will inevitably miss at least a few small issues.

Examples of issues that might necessitate the use of a contingency fund:

- Inadequate initial estimates
- Small items not covered in planning
- Errors in initial estimates
- Small deviations due to inevitable delays

Note that a contingency fund is not designed to manage major deviations or scope changes.

A simple and effective form of contingency planning is setting aside a contingency fund consisting of a fixed percentage of all resources (time, money, people) in addition to the amounts spelled out in the final budget. Ten percent is a typical amount, but that can vary depending on the size and type of project, as well as the type of industry.

One of the chief difficulties of contingency planning is getting people to agree on exactly what is and is not covered by a contingency fund and how it applies in specific circumstances. A considerable amount of research has been done on this topic, but there is still no clear consensus. For that reason, before launching a major project, it would be wise to investigate the ins and outs of contingency planning at your organization in particular and in your industry in general.

Contingency planning is closely related to risk management, which is discussed in Chapter 6. When you are working on small projects of limited complexity, you can probably assume that a fixed percentage contingency plan will cover most risks. However, for highly complex, technically challenging projects, it's important to distinguish between generic budget planning contingencies (using a fixed percentage) and the more sophisticated modelling of risk for uncertainty.

If money is not available from other sources, then cost overruns typically result in a change in the project's scope or a reduction in overall quality. To prevent this, organizations build contingency funds into their budgets. Technically, a contingency fund is a financial reserve that is allocated for identified risks that are accepted and for which contingent or mitigating responses are developed. The exact amount of a contingency is typically 10% to 15% of the total budget.

Contingency funds are often available to pay for an agreed-upon scope change. However, some project managers make a practice of treating a contingency fund as a "Get Out of Jail Free" card that they can use to escape any cost limitations. Some, as a practical matter, will artificially inflate a contingency fund to ensure that they have plenty of resources to draw to manage any unforeseen future risks. But that is never a good idea because if you wind up with a large contingency fund that you ultimately don't spend, you have

essentially held that money hostage (i.e., lost opportunity costs) from the rest of the enterprise. That can be as damaging to your organization's mission as a cost overrun that prevents you from finishing a project.

As explained, contingency funds are a form of risk management. They are a necessary tool for dealing with uncertainty. Unfortunately, as necessary as they are, it's not always possible to build them into your approved budget. For example, if you are competitively bidding on a contract that will be awarded at the lowest cost, then including a contingency fund in your estimate will almost certainly guarantee that your company won't win the contract. It is simply not practical to include a contingency fund in a lump sum contract.

In the living order approach to this problem, the owner maintains a shared contingency fund instead and makes it available, upon justification, for all project stakeholders. This approach helps ensure that project participants will work collaboratively with the project sponsor to solve any problems they might notice, confident that there is money available to address problems that threaten project value or to leverage opportunities that will provide greater project value. For example, in a lecture on Lean and integrated project delivery, David Thomack, a long-time veteran of the construction industry, explained how the Boldt Company and other stakeholders involved in a $2 billion healthcare project protected millions of dollars in contingency funding, which was then ultimately shared among all stakeholders (Thomack, 2018). Such shared contingency funds are typically spelled out in the project contract and are an effective tool for managing risk and uncertainty. Although some organizations only manage out-of-pocket project costs, the best practice is to manage total costs, including costs associated with staff (engineering, purchasing, testing, etc.) working on the project.

3.11. Managing Budget

Projects seldom go according to plan in every detail. It is necessary for the project manager to be able to identify when costs are varying from the budget and manage those variations.

Evaluating the Budget During the Project

A project manager must regularly compare the amount of money spent with the budgeted amount and report this information to managers and stakeholders. It is necessary to establish an understanding of how this progress will be measured and reported.

Reporting Budget Progress on John's Move

In *John's Move* example, he estimated that the move would cost about $1,500 and take about 16 days. Eight days into the project, John has spent $300. John tells his friends that the project is going well because he is halfway through the project but has only spent a fifth of his budget. John's friend Carlita points out that his report is not sufficient because he did not compare the amount spent to the budgeted amount for the activities that should be done by the eighth day.

As John's friend pointed out, a budget report must compare the amount spent with the amount that is expected to be spent by that point in the project. Basic measures such as the percentage of activities completed, percentage of measurement units completed, and percentage of budget spent are adequate for less complex projects, but more sophisticated techniques are used for projects with higher complexity.

3.12. Role of Communication in PM

Communications management is about keeping everybody in the loop. The communications planning process concerns defining the types of information you will deliver, who will receive it, the format for communicating it, and the timing of its release and distribution. It turns out that 90% of a project manager's job is spent on communication, so it's important to make sure everybody gets the right message at the right time.

The first step in defining your communication plan is figuring out what kind of communication your stakeholders need from the project so they can make good decisions. This is called the **communications requirements analysis.** Your project will produce a lot of information; you don't want to overwhelm your stakeholders with all of it. Your job is to figure out what they feel is valuable. Furthermore, communicating valuable information doesn't mean you always paint a rosy picture.

Communications to stakeholders may consist of either good news or bad news. The point is that you don't want to bury stakeholders in too much information, but you do want to give them enough so that they're informed and can make appropriate decisions.

Communications technology has a major impact on how you keep people in the loop. Methods of communicating can take many forms, such as written reports, conversations, emails, formal status reports, meetings, online databases, online schedules, and project websites. You should consider several factors before deciding what methods you'll choose to transfer information. The timing of the information exchange or the need for updates is the first factor. Do you need to procure new technology or systems, or are there systems already in place that will work? The technologies available to you should figure into your plan of how you will keep everyone notified of project status and issues. Staff experience with the technology is another factor. Are there project team members and stakeholders who are experienced in using this technology, or will you need to train them?

Finally, consider the duration of the project and the project environment. Will the technology you're choosing work throughout the life of the project, or will it have to be upgraded or updated at some point? And how does the project team function? Are they located together or spread out across several campuses or locations? The answers to these questions should be documented in the communication plan.

All projects require a sound communication plan, but not all projects will have the same types of communication or the same methods for distributing the information. The communication plan documents the types of information needs the stakeholders have, when the information should be distributed, and how the information will be delivered.

The types of information you will communicate typically include project status, project scope statements and updates, project baseline information, risks, action items, performance measures, project acceptance, and so on. It's important that the information needs of the stakeholders be determined as early in the planning phase of the project management life cycle as possible so that as you and your team develop project planning documents, you already know who should receive copies of them and how they should be delivered.

3.13. Types of Communication

Completing a complex project successfully 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 projects are performed by teams that interact primarily through electronic communication and are, therefore, called virtual teams. To avoid miscommunication that can harm trust and to include team members in a project culture, the project team needs a plan for communicating reliably and in a timely manner. This planning begins with understanding two major categories of communication.

Synchronous Communications

- *Live meeting:* Gathering of team members at the same location
- *Conference call:* A telephone call in which several people participate
- *Audio conference:* Like a conference call, but conducted online using software like Skype
- *Computer-assisted conference*: Audio conference with a connection between computers that can display a document or spreadsheet that can be edited by both parties
- *Video conference:* Similar to an audio conference but with live video of the participants. Some laptop computers have built-in cameras to facilitate video conferencing
- *IM(instant messaging):* Exchange of text or voice messages using pop-up windows on the participants' computer screens
- *Texting:* Exchange of text messages between mobile phones, pagers, or personal digital assistants (PDAs)—devices that hold a calendar, a contact list, a task list, and other support programs.

Modern communication technologies make it possible to assemble project teams from anywhere in the world. Most people work during daylight hours, which can make synchronous meetings difficult if the participants are in different time zones. However, it can be an advantage in some circumstances; for example, if something must be done by the start of business tomorrow, team members in Asia can work on the problem during their regular work hours while team members in North America get some sleep.

Asynchronous Communications

Getting a team together at the same time can be a challenge—especially if they are spread out across time zones. Many types of communication do not require that the parties be present at the same time. This type of communication is asynchronous.

There are several choices of asynchronous communication:

- Mail and Package Delivery
- Fax
- Email
- Project Blog**:** A blog is an online journal that can be private, shared by invitation, or made available to the world. Some project managers keep a journal in which they summarize the day's challenges and triumphs and the decisions they made. They return to this journal at a later date to review their decision-making process after the results of those decisions are known to see if they can learn from their mistakes. Many decisions in project management are made with incomplete knowledge; therefore, reflecting on previous decisions to develop this decision-making skill is important to growth as a project manager.

3.14. Communication and Project Manager

As a project manager, you might be responsible for writing RFPs for your organization's projects, or proposals in response to RFPs publicized by other organizations. You might also be responsible for drafting parts of a contract such as language describing the scope of work. At the very least, you will need to be conversant enough with contract terminology so that you can ensure that a contract proposed by your organization's legal department adequately translates the project requirements into legal obligations. Whatever form they take, to be useful, RFPs, proposals, and contracts must be specific enough to define expectations for the project yet flexible enough to allow for the inevitable learning that occurs as the project unfolds in the uncertain, living order of the modern world. All three types of documents are forms of communication that express a shared understanding of project success, with the level of detail increasing from the RFP stage to the contract.

Throughout the proposal and contract stages, it's essential to be clear about your expectations regarding:

- Deliverables
- Schedule
- Expected level of expertise
- Price
- Expected quality
- Capacity
- Expected length of relationship (short- or long-term)

Take care to spell out:

- Performance requirements
- Basis for payment
- Process for approving and pricing changes to the project plan
- Requirements for monitoring and reporting on the project's health

At a minimum, a proposal should discuss:

- *Scope:* At the proposal stage, assume you can only define about 80% of the scope. As you proceed through the project, you'll learn more about it and be better able to define the last 20%.
- *Schedule:* You don't necessarily need to commit to a specific number of days at the proposal stage, but you should convey a general understanding of the overall commitment and whether the schedule is mission-critical. In many projects, the schedule can turn out to be somewhat arbitrary or at least allow for more variability than you might be led to believe at first.
- *Deliverables:* Make it clear that you have some sense of what you are committing to, but only provide as many details as necessary.
- *Cost/Resources:* Again, make clear that you understand the general picture and provide only as many specifics as are helpful at the proposal stage.
- *Terms:* Every proposal needs a set of payment terms so it's clear when payments are due. Unless you include "net 30" or "net 60" in a proposal, you could find yourself in a situation in which customers refuse to part with their cash until the project is complete.

- *Clarifications and Exclusions:* No proposal is perfect, so every proposal needs something that speaks to the specific uncertainty associated with that particular proposal. Take care to write this part of a proposal in a customer-friendly way and avoid predatory clarifications and exclusions. For example, you might include something like this: "We've done our best to write a complete proposal, but we have incomplete knowledge of the project at this point. We anticipate working together to clarify the following issues"—and then conclude with a list of issues.

If you are on the receiving end of a proposal, remember a potential supplier probably has far more experience than you do in its particular line of business. Keep the lines of communication open and engage with suppliers to use their expertise to help refine deliverables and other project details.

Assessing New Communication Technologies

New technologies for communicating electronically appear with increasing frequency. Using a new technology that is unfamiliar to the team increases the technology complexity, which can cause delays and increase costs. To decide if a new technology should be included in a communications plan, seek answers to the following questions:

- Does the new communication technology provide a competitive advantage for the project by reducing cost, saving time, or preventing mistakes?
- Does the project team have the expertise to learn the new technology quickly?
- Does the company offer support such as a help desk and equipment service for new communication technology?
- What is the cost of training and implementation in terms of time and money?

Communication Plan Template

So, how do you create a communication plan? Follow these guidelines:

1. Identify your stakeholders (to whom).
2. Identify stakeholder expectations (why).
3. Identify communication necessary to satisfy stakeholder expectations and keep them informed (what).
4. Identify the time frame and/or frequency of communication messages (when).
5. Identify how the message will be communicated (the stakeholder's preferred method) (how).
6. Identify who will communicate each message (who).
7. Document items – templates, formats, or documents the project must use for communicating.

3.15. Virtual PM

Managing a team of people who work side-by-side in the same office is difficult enough. But what about managing a virtual team—that is, a team whose members are dispersed at multiple geographical locations? In the worldwide marketplace, such teams are essential. Deborah L. Duarte and Nancy Tennant Snyder explain the trend in their helpful workbook, Mastering Virtual Teams:

> Understanding how to work in or lead a virtual team is now a fundamental requirement for people in many organizations.... The fact is that leading a virtual team is not like leading a traditional team. People who lead and work on virtual teams need to have special skills, including an understanding of human dynamics and performance without the benefit of normal social cues, knowledge of how to manage across functional areas and national cultures, skill in managing their careers and others without the benefit of face-to-face interactions, and the ability to use leverage and electronic communication technology as their primary means of communicating and collaborating. (Duarte & Tennant Snyder, 2006, p. 4)

When properly managed, collaboration over large distances can generate serious advantages. For one thing, the diversity of team members, as per Siebdrat et al. (2009), "exposes members to heterogeneous sources of work experience, feedback, and networking opportunities." At the same time, the team's diversity enhances the "overall problem-solving capacity of the group by bringing more vantage points to bear on a particular project" (Siebdrat et al., 2009, p. 65). Often, engaging with stakeholders via email allows for more intimacy and understanding than face-to-face conversations, which can sometimes be awkward or ineffective, depending on the personality types involved.

However, research consistently underscores the difficulties in effectively getting a dispersed team to work. In a widely cited study of 70 virtual teams, Vijay Govindarajan and Anil K. Gupta (2001) found that "only 18% considered their performance 'highly successful' and the remaining 82% fell short of their intended goals. In fact, fully one-third of the teams ... rated their performance as largely unsuccessful". Furthermore, research has consistently shown that virtual team members are "overwhelmingly unsatisfied" with the technology available for virtual communication and do not view it "as an adequate substitute for face-to-face communication" (Purvanova, 2014).

Given these challenges, what's a virtual team manager to do? It helps to be realistic about the barriers to collaboration that arise when your team is scattered around the office park or around the globe.

The Perils of Virtual Distance

Physical distance—the actual space between team members—can impose all sorts of difficulties. Most studies have shown that teams that are located in the same space, where members can build personal, collaborative relationships with one another, are usually more effective than teams that are dispersed across multiple geographical locations.

> Potential issues include difficulties in communication and coordination, reduced trust, and an increased inability to establish a common ground.... Distance also brings with it other issues, such as team members having to negotiate multiple time zones and requiring them to reorganize their work days to accommodate others' schedules. In such situations, frustration and confusion can ensue, especially if coworkers are regularly unavailable for discussion or clarification of task-related issues. (Siebdrat, et. al., 2009, p. 64)

Even dispersing teams on multiple floors of the same building can decrease the team's overall effectiveness, in part because team members "underestimate the barriers to collaboration deriving from, for instance, having to climb a flight of stairs to meet a teammate face-to-face." Team members end up behaving as if they were scattered across the globe. As one team leader at a software company noted, teams spread out within the same building tend to "use electronic communication technologies such as e-mail, telephone, and voicemail just as much as globally dispersed teams do" (Siebdrat, et. al., 2009, p. 64).

Communication options like video conferences, text messages, and email can do wonders to bridge the gap. But you do need to make sure your communication technology is working seamlessly. Studies show that operational glitches (such as failed Skype connections or thoughtlessly worded emails) can contribute to a pernicious sense of distance between team members. Karen Sobel-Lojeski and Richard Reilly coined the term virtual distance to refer to the "psychological distance created between people by an over-reliance on electronic communications" (2008, xxii). Generally speaking, building a team solely through electronic communication is tough. That's why it's helpful to meet face-to-face occasionally. A visit from a project manager once a year or once a quarter can do wonders to nurture relationships among all team members and keep everyone engaged and focused on project success.

In their book Uniting the Virtual Workforce, Sobel-Lojeski and Reilly document some "staggering effects" of virtual distance:

- 50% decline in project success (on-time, on-budget delivery).
- 90% drop in innovation effectiveness.
- 80% plummet in work satisfaction.
- 83% fall off in trust.
- 65% decrease in role and goal clarity.
- 50% decline in leader effectiveness (2008, xxii).

The Special Role of Trust in a Virtual PM

So, what's the secret to making virtual teams work for you? We've already discussed the importance of building trust in any team. However, building trust is a special concern for virtual teams. Erin Meyer describes the situation as follows: "Trust takes on a whole new meaning in virtual teams. When you meet your workmates by the water cooler or photocopier every day, you know instinctively who you can and cannot trust. In a geographically distributed team, trust is measured almost exclusively in terms of reliability" (Meyer, 2010).

All sorts of problems can erode a sense of reliability on a virtual team, but most of them come down to a failure to communicate. Sometimes, the problem is an actual, technical inability to communicate (for example, because of unreliable cell phone service at a remote factory); sometimes, the problem is related to scheduling (for example, a manager in Japan being forced to hold phone meetings at midnight with colleagues in North America); and sometimes the problem is simply a failure to understand a message once it is received. Whatever the cause, communication failures have a way of eroding trust among team members as they begin to see each other as unreliable.

As illustrated in Figure 3.8, communicating clearly will lead your team members to perceive you as reliable, encouraging them to trust you.

Figure 3.8 The benefits of clear communication

Leigh Thompson, a professor at Northwestern University's Kellogg School of Management, offers a number of practical suggestions for improving virtual teamwork, including the following:

- Verify that your communication technology works reliably and that team members know how to use it.
- Take a few minutes before each virtual meeting to share some personal news so that team members can get to know each other.
- Use video conferencing whenever possible so everyone can see each other. The video image can go a long way toward humanizing your counterparts in distant locales. If video conferencing is not an option, try at least to keep a picture of the person you're talking to visible, perhaps on your computer. Studies have shown that even a thumbnail image can vastly improve your ability to reach an agreement with a remote team member. (Thompson, 2015)

3.16. Key Terms

Key Terms

- **Activity:** An element of work performed during a project.
- **Analogous Estimating:** This method uses information from a previous project to estimate the cost of completing a similar project in the future. This provides a quick estimate but should be used with caution. Analogous estimating only works when comparing projects that are similar in scope and will be completed in similar conditions.
- **Communications Management:** The communications planning process concerns defining the types of information you will deliver, who will receive it, the format for communicating it, and the timing of its release and distribution.
- **Communications Requirements Analysis:** The first step in defining your communication plan is figuring out what kind of communication your stakeholders need from the project so they can make good decisions.
- **Contingency Fund:** This is a number of resources set aside to cover unanticipated costs.
- **Contingency Plan:** A contingency plan defines alternate paths for the project in case various risks are realized.
- **Direct Cost:** An expense that can be traced directly to (or identified with) a specific cost center or cost objects such as a department, process, or product.
- **Direct Project Overhead Costs:** Costs that are directly tied to specific resources in the organization that is being used in the project. Examples include the cost of lighting, heating, and cleaning the space where the project team works.
- **Gantt Chart:** A type of bar chart, developed by Henry Gantt, that illustrates a project schedule.
- **General and Administrative (G&A) Overhead Costs:** The indirect costs of running a business, such as IT support, accounting, and marketing.
- **Network Diagram:** A way to visualize the interrelationships of project activities.
- **Resource Leveling:** Aims at smoothing the stock of resources on hand, reducing both excess inventories and shortages.
- **Resource Management:** The efficient and effective deployment of an organization's resources when they are needed.
- **Single Point Estimation:** Estimate obtained from just one estimator.
- **Work Breakdown Structure (WBS):** Hierarchical outline of all the deliverables involved in completing a project. The WBS is part of a project scope statement. The creation of a WBS is one of the first steps in organizing and scheduling the work for a project.

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where otherwise noted. Modifications: Changes to the terms activity, communications management, contingency plan, gantt chart, network diagram, resource management and single point estimation. Removed: bottom-up, cost of quality, determination of resource costs, reserve analysis, vendor bid analysis,

CHAPTER 4 PROJECT MANAGEMENT - THE EXECUTION & THE MONITORING PHASES

Chapter Overview

4.1. Chapter Introduction

Learning Objectives

By the end of this chapter, you should be able to:

1. Describe the process and importance of quality planning.
2. Outline the importance of managing project progress.
3. Examine how work is controlled and monitored during the execution and implementation phase.
4. Describe details of quality monitoring practices and report on the project's progress to various stakeholders.
5. Calculate various earned value analysis metrics.
6. Interpret various earned value analysis metrics.

4.2. Quality in PM

It's not enough to make sure you get a project done on time and under budget. You need to be sure you make the right product to suit your stakeholders' needs. Quality means making sure that you build what you said you would and that you do it as efficiently as you can. And that means trying not to make too many mistakes and always keeping your project working toward the goal of creating the right product.

Everybody "knows" what quality is. However, the way the word is used in everyday life is a little different from how it is used in project management. Just like the triple constraint (scope, cost, and schedule), you manage the quality of a project by setting goals and taking measurements. That's why you must understand the quality levels your stakeholders believe are acceptable, and ensure that your project meets those targets, just like it needs to meet their budget and schedule goals.

Customer satisfaction is about making sure that the people who are paying for the end product are happy with what they get. When the team gathers requirements for the specification, they try to write down all of the things that the customers want in the product so that they know how to make them happy. Some requirements can be left unstated. Those are the ones that are implied by the customer's explicit needs. For example, some requirements are just common sense (e.g., a product that people hold can't be made from toxic chemicals that may kill them). It might not be stated, but it's definitely a requirement.

"Fitness to use" is about making sure that the product you build has the best design possible to fit the customer's needs. Which would you choose: a product that is beautifully designed, well constructed, solidly built, and all-around pleasant to look at but does not do what you need or a product that does what you want despite being ugly and hard to use? You'll always choose the product that fits your needs, even if it's seriously limited. That's why it's important that the product both does what it is supposed to do and does it well. For example, you could pound in a nail with a screwdriver, but a hammer is a better fit for the job.

Conformance to requirements is the core of both customer satisfaction and fitness to use and is a measure of how well your product does what you intend. Above all, your product needs to do what you wrote down in your requirements document. Your requirements should take into account what will satisfy your customer and the best design possible for the job. That means conforming to both stated and implied requirements.

In the end, your product's quality is judged by whether you built what you said you would build.

Quality planning focuses on taking all of the information available to you at the beginning of the project and figuring out how you will measure quality and prevent defects. Your company should have a quality policy that states how quality is measured across the organization. You should make sure your project follows the company policy and any government rules or regulations on how to plan quality for your project.

You need to plan which activities you will use to measure the quality of the project's product. And you'll need to think about the cost of all the quality-related activities you want to do. Then, you'll need to set some guidelines for what you will measure against. Finally, you'll need to design the tests you will run when the product is ready to be tested.

Quality and Grade

According to the International Organization for Standardization (ISO), **quality** is "the degree to which a set of inherent characteristics fulfill requirements." The requirements of a product or process can be categorized or

given a grade that will provide a basis for comparison. The quality is determined by how well something meets the requirements of its grade.

For most people, the term quality also implies good value—getting your money's worth. For example, even low-grade products should still work as expected, be safe to use, and last a reasonable amount of time. Consider the following examples.

Example: Quality of Gasoline Grades

Petroleum refiners provide gasoline in several different grades based on the octane rating because higher octane ratings are suitable for higher compression engines. Gasoline must not be contaminated with dirt or water, and the actual performance of the fuel must be close to its octane rating. A shipment of low-grade gasoline graded as 87 octane that is free of water or other contaminants would be of high quality, while a shipment of high-grade 93 octane gas that is contaminated with dirt would be of low quality.

Statistics

Determining how well products meet grade requirements is done by taking measurements and then interpreting those measurements. **Statistics**—the mathematical interpretation of numerical data—are useful when interpreting large numbers of measurements and are used to determine how well the product meets a specification when the same product is made repeatedly. Measurements made on samples of the product must be within control limits—the upper and lower extremes of allowable variation—and it is up to management to design a process that will consistently produce products between those limits.

Instructional designers often use statistics to determine the quality of their course designs. Student assessments are one way in which instructional designers are able to tell whether learning occurs within the control limits.

Example: Setting Control Limits

A petroleum refinery produces large quantities of fuel in several grades. Samples of the fuels are extracted and measured at regular intervals. If a fuel is supposed to have an 87-octane performance, samples of the fuel should produce test results that are close to that value. Many of the samples will have scores that are different from 87. The differences are due to random factors that are difficult or expensive to control. Most of the samples should be close to the 87 rating and none of them should be too far off. The manufacturer has grades of 85 and 89, so they decided that none of the samples of the 87-octane fuel should be less than 86 or higher than 88.

If a process is designed to produce a product of a certain size or other measured characteristic, it is impossible to control all the small factors that can cause the product to differ slightly from the desired measurement. Some of these factors will produce products that have measurements that are larger than desired and some will have the opposite effect. If several random factors affect the process, they tend to offset each other, and the most common results are near the middle of the range; this phenomenon is called the central limit theorem.

If the range of possible measurement values is divided equally into subdivisions called bins, the measurements can be sorted, and the number of measurements that fall into each bin can be counted. The result is a frequency distribution that shows how many measurements fall into each bin. If the effects that are causing the differences are random and tend to offset each other, the frequency distribution is called a normal distribution, which resembles the shape of a bell with edges that flare out. The edges of a theoretical normal distribution curve get very close to zero but do not reach zero.

Example: Normal Distribution

A refinery's quality control manager measures many samples of 87 octane gasoline, sorts the measurements by their octane rating into bins that are 0.1 octane wide, and then counts the number of measurements in each bin. Then, she creates a frequency distribution chart of the data, as shown in Figure 4.1.

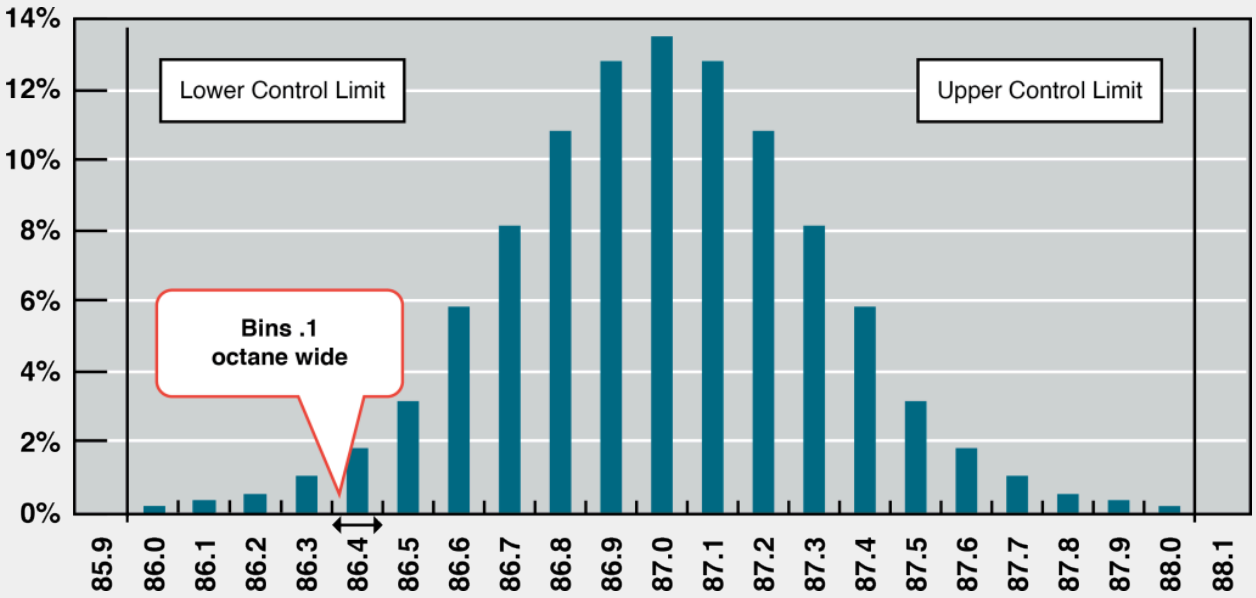

Figure 4.1: Normal Distribution of Measurements

It is common to take samples—randomly selected subsets from the total population—and measure and compare their qualities since measuring the entire population would be cumbersome, if not impossible. If the sample measurements are distributed equally above and below the centre of the distribution as they are in Figure 4.1, the average of those measurements is also the centre value that is called the mean and is represented in formulas by the lowercase Greek letter μ (pronounced mu). The amount of difference of the measurements from the central value is called the sample standard deviation or just the standard deviation.

The first step in calculating the standard deviation is subtracting each measurement from the central value (mean) and then squaring that difference. (Recall from your mathematics courses that squaring a number is multiplying it by itself and that the result is always positive.) The next step is to sum these squared values and divide by the number of values minus one. The last step is to take the square root. The result can be thought of as an average difference. (If you had used the usual method of taking an average, the positive and negative numbers would have summed to zero.) Mathematicians represent the standard deviation with the lowercase Greek letter (pronounced sigma). If all the elements of a group are measured, instead of just a sample, it is called the standard deviation of the population, and in the second step, the sum of the squared values is divided by the total number of values.

Figure 4.1 shows that the most common measurements of octane rating are close to 87 and that the other measurements are distributed equally above and below 87. The shape of the distribution chart supports the central limit theorem's assumption that the factors that are affecting the octane rating are random and tend to offset each other, which is indicated by the symmetric shape. This distribution is a classic example of a normal distribution. The quality control manager notices that none of the measurements are above 88 or below 86 so they are within control limits, and she concludes that the process is working satisfactorily.

Example: Standard Deviation of Gasoline Samples

The refinery's quality control manager uses the standard deviation function in her spreadsheet program to find the standard deviation of the sample measurements and finds that for her data, the standard deviation is 0.3 octane. She marks the range on the frequency distribution chart to show the values that fall within one sigma (standard deviation) on either side of the mean (Figure 4.2).

For normal distributions, about 68.3% of the measurements fall within one standard deviation on either side of the mean. This is a useful rule of thumb for analyzing some types of data. If the variation between measurements is caused by random factors that result in a normal distribution, and someone tells you the mean and the standard deviation, you know that a little over two-thirds of the measurements are within a standard deviation on either side of the mean. Because of the shape of the curve, the number of measurements within two standard deviations is 95.4%, and the number of measurements within three standard deviations is 99.7%. For example, if someone said the average (mean) height for adult men in the United States is 178 cm (70 inches) and the standard deviation is

about 8 cm (3 inches), you would know that 68% of the men in the United States are between 170 cm (67 inches) and 186 cm (73 inches) in height. You would also know that about 95% of adult men in the United States are between 162 cm (64 inches) and 194 cm (76 inches) tall and that almost all of them (99.7%) are between 154 cm (61 inches) and 202 cm (79 inches) tall. These figures are referred to as the 68-95-99.7 rule.

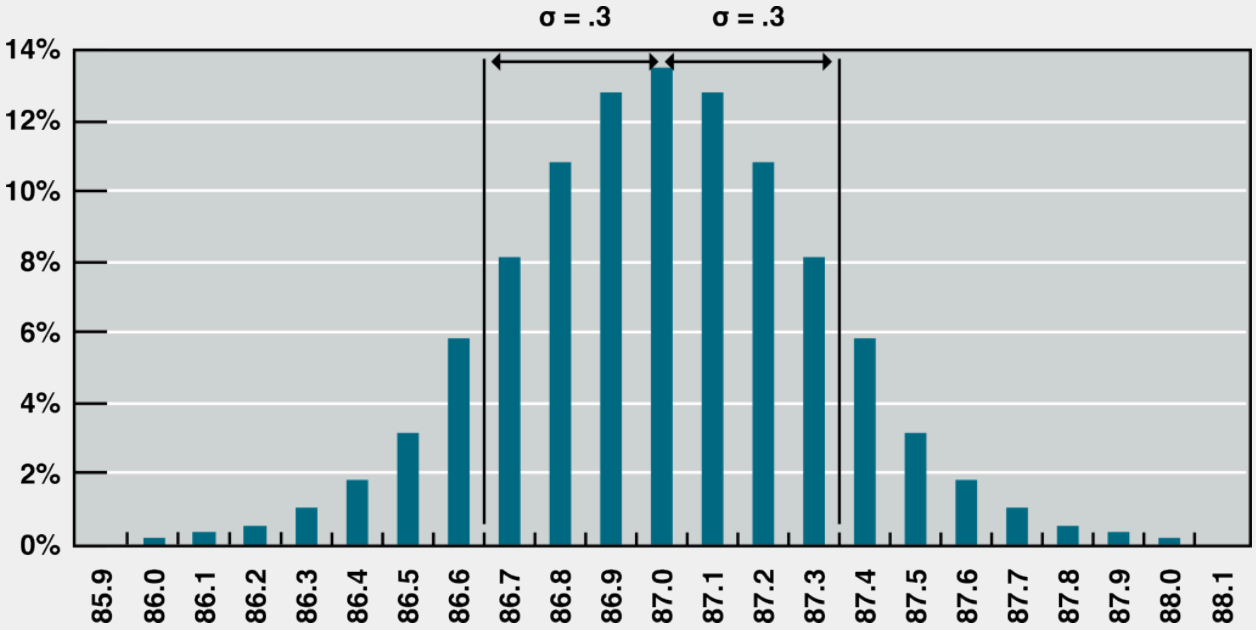

Figure 4.2: One Sigma Range Most of the measurements are within 0.3 octane of 87

4.3. Quality Planning

High quality is achieved by planning for it rather than by reacting to problems after they are identified. Standards are chosen, and processes are put in place to achieve those standards.

Measurement Terminology

During the execution phase of the project, services and products are sampled and measured to determine if the quality is within control limits for the requirements and to analyze causes for variations. This evaluation is often done by a separate quality control group, and knowledge of a few process measurement terms is necessary to understand their reports. Several of these terms are similar, and it is valuable to know the distinction between them.

The quality plan specifies the control limits of the product or process; the size of the range between those limits is the tolerance. **Tolerances** are often written as the mean value, plus or minus the tolerance. The plus and minus signs are written together, ±.

Example: Tolerance in Gasoline Production

The petroleum refinery chose to set its control limits for 87-octane gasoline at 86 and 88-octane. The tolerance is 87 ± 1. Tools are selected that can measure the samples closely enough to determine if the measurements are within control limits and if they are showing a trend. Each measurement tool has its own tolerances.

The choice of tolerance directly affects the cost of quality (COQ). In general, it costs more to produce and measure products that have small tolerances. The costs associated with making products with small tolerances for variation can be very high and not proportional to the gains. For example, if the cost of evaluating each screen as it is created in an online tutorial is greater than delivering the product and fixing any issues after the fact, then the COQ may be too high and the instructional designer will tolerate more defects in the design.

Defining and Meeting Client Expectations

Clients provide specifications for the project that must be met for the project to be successful. Recall that meeting project specifications is one definition of project success. Clients often have expectations that are more difficult to capture in a written specification. For example, one client will want to be invited to every meeting of the project and will then select the ones that seem most relevant. Another client will want to be invited only to project meetings that need client input. Inviting this client to every meeting will cause unnecessary frustration. Listening to the client and developing an understanding of the expectations that are not easily captured in specifications is important to meeting those expectations.

Project surveys can capture how the client perceives the project performance and provide the project team

with data that are useful in meeting client expectations. If the results of the surveys indicate that the client is not pleased with some aspect of the project, the project team has the opportunity to explore the reasons for this perception with the client and develop recovery plans. The survey can also help define what is going well and what needs improvement.

Sources of Planning Information

Planning for quality is part of the initial planning process. The early scope, budget, and schedule estimates are used to identify processes, services, or products where the expected grade and quality should be specified. Risk analysis is used to determine which of the risks to the project could affect quality.

Techniques

Several different tools and techniques are available for planning and controlling the quality of a project. The extent to which these tools are used is determined by the project complexity and the quality management program in use by the client. The following represents the quality planning tools available to the project manager.

Cost-benefit analysis is looking at how much your quality activities will cost versus how much you will gain from doing them. The costs are easy to measure; the effort and resources it takes to do them are just like any other task on your schedule. Since quality activities don't actually produce a product, it is sometimes harder for people to measure the benefit. The main benefits are less reworking, higher productivity and efficiency, and more satisfaction from both the team and the customer.

Benchmarking means using the results of quality planning on other projects to set goals for your own. You might find that the last project in your company had 20% fewer defects than the one before it. You should want to learn from a project like that and put into practice any of the ideas they used to make such a great improvement. Benchmarks can give you some reference points for judging your own project before you even start the work.

Design of Experiments is the list of all the kinds of tests you are going to run on your product. It might list all the kinds of test procedures you'll do, the approaches you'll take, and even the tests themselves. (In the software world, this is called test planning.)

Cost of Quality is what you get when you add up the cost of all the prevention and inspection activities you are going to do on your project. It doesn't just include the testing. It includes any time spent writing standards, reviewing documents, meeting to analyze the root causes of defects, and reworking to fix the defects once they're found by the team: in other words, absolutely everything you do to ensure quality on the project. Cost of quality can be a good number to check to determine whether your project is doing well or having trouble. Say your company tracks the cost of quality on all of its projects; then you could tell if you are spending more or less than has been spent on other projects to get your project up to quality standards.

Control Charts can be used to define acceptable limits. If some of the functions of a project are repetitive, statistical process controls can be used to identify trends and keep the processes within control limits. Part of the planning for controlling the quality of repetitive processes is to determine what the control limits are and how the process will be sampled.

Cause-and-effect diagrams can help in discovering problems. When control charts indicate an assignable cause for a variation, it is not always easy to identify the cause of a problem. Discussions that are intended to

discover the cause can be facilitated using a cause-and-effect or fishbone diagram where participants are encouraged to identify possible causes of a defect.

4.4. Monitoring for Active Control

When setting up monitoring and controlling systems for a new project, it's essential to keep in mind that not all projects are the same. What works for one project might not work for another, even if both projects seem similar. Also, the amount of monitoring and controlling required might vary with your personal experience. If you've never worked on a particular type of project before, the work involved in setting up a reliable monitoring and controlling system will typically be much greater than the up-front work required for a project that you've done many times before. For projects you repeat regularly, you'll typically have standard processes in place that will make it easy for you to keep an eye on the project's overall performance.

Exactly which items you need to monitor will vary from project to project and from one industry to another. But in any industry, you usually only need to monitor a handful of metrics. There's no need to over-complicate things. For example, when managing major construction projects for the Wisconsin Department of Transportation, Gary Whited focused on these major items:

- Schedule
- Cost/budget
- Issues specific to the project
- Risk

He also recommends monitoring the following:

- Quality
- Safety
- Production rates
- Quantities

In other kinds of projects, you will probably need to monitor different issues. But it's always a good idea to focus on information that can serve as early warnings, allowing you to change course if necessary. This typically includes the following:

- Current status of schedule and budget
- Expected cost to complete
- Expected date(s) of completion
- Current/expected problems, impacts, and urgency
- Causes for schedule/cost overruns

As Whited explains, the bottom line is this: "If it's important to the success of your project, you should be monitoring it" (Whited, 2014).

Note that measuring the percentage completed on individual tasks is useful in some industries where tasks play out over a long period of time. According to Dave Pagenkopf, the percent completion of individual tasks is meaningless in the IT world:

> "The task is either complete or not complete. At the project level, the percent complete may mean something. You really do need to know which tasks/features are 100% complete. However, sloppy progress reports can generate confusion at this point. 100% of the functions in a software product 80% complete is not the same as having 80% of the features 100% complete. A poorly designed progress

report can make these can look the same, when they most definitely are not" (pers. comm., November 13, 2017).

In addition to deciding what to monitor, you need to decide how often to take a particular measurement. As a general rule, you should measure as often as you need to make meaningful course corrections. For some items, you'll need to monitor continuously; for others, a regular check-in is appropriate. Most projects include major milestones or phases that serve as a prime opportunity for monitoring important indicators. As Gary Whited notes, "The most important thing is to monitor your project while there is still time to react. That's the reason for taking measurements in the first place" (2014).

4.5. Earned Value Analysis

Earned value analysis (EVA) is a monitoring and controlling process that compares project progress to the project baseline (original plan). EVA measures the performance of a project in terms of cost and schedule. It can tell the project team if a project is:

- Behind Schedule
- Ahead of Schedule
- Under Budget
- Over Budget

EVA provides hard numbers for making these judgements and can be used to forecast where a project will end up in terms of time and cost. As a result, EVA helps the project manager clearly communicate project progress to all stakeholders and can focus the attention of the project team on any changes needed for the project to be completed on time and on budget. Most project management information systems (PMIS) can calculate earned value metrics if a baseline is properly set and the earned value inputs are provided. Project managers who do not conduct an earned value analysis run the risk of misinterpreting or miscommunicating the meaning of the project information that is collected during the execution phase.

EVA Example

For example, assume that the direct costs of a project are budgeted at $100,000, and the project is scheduled to take 12 months. If it is three months into the project and $25,000 has been spent, a naive project manager might assume that the project is 25% done and is on track to finish within the project timeline and budget.

In this example, the project is certainly 25% done as far as the time allowed for the project, and 25% done with the budget, but what is not known is which activities have been worked on and if those activities are complete or still in progress. If only 10% of the scheduled work has actually been completed, then the project may be in trouble. Alternatively, if 50% of the scheduled work has been completed, then the project may end up being done much earlier and with much less expense than planned. Either situation requires action:

- If a project is going to be over budget and/or take more time, the project manager needs to figure out what can be done to correct the situation. Should they try to get more resources and time, or should they re-evaluate the project entirely?
- If a project is going to be done in significantly less time and/ or with significantly less cost, then the project manager should see if some of the resources allocated for the project can be released to other projects and priorities in the organization and the impact of an earlier completion date should be evaluated.

Before attempting the calculations involved in an earned value analysis of a project, it is important to

understand the three basic inputs for EVA calculations. The three basic inputs are Planned Value (PV), Actual Costs (AC), and Earned Value (EV).

Planned Value (PV)

Planned Value—Refers to the expected cost that will be spent on the project over its lifetime. For each activity, there is a total Planned Value (cost). More importantly, the amount that was going to be spent on each activity over time is also known.

Consider the information presented on Project Breakdown in Table 4.1. The amount that the project team thinks an activity will cost is called the planned value for that activity.

Table 4.1: Project Breakdown

Sequence Order	Activity	Planned Value (PV)	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
1	Design celebratory cake	$50	$50					
2	Order ingredients and equipment	$225	$150	$75				
3	Mix cake ingredients	$50		$50				
4	Bake cake	$120		$120				
5	Cool cake	$0						
6	Mix frosting	$20			$20			
7	Apply frosting	$80			$50	$20	$10	
8	Cool frosting							
9	Apply decorations	$25					$25	
10	Pack and ship cake	$100					$100	
11	Confirmation of receipt							
12	Bill customer	$10						$10
	Total	$680	$200	$245	$70	$20	$135	$10

Actual Costs (AC)

The **Actual Costs**—this refers to the completed work—are the easiest of the inputs to understand. AC refers to any given activity cost at a specific time. Actual costs don't reflect what was planned to be spent but rather what was spent. This information is obtained from the accounting department, and the data is based on invoices, paychecks and receipts related to the activity. While the project manager may have been planning to spend $78 on Activity 1 by the end of period one, the accounting department may inform him or her that the actual cost (AC) at the end of period one for Activity 1 is $50!!

However, the project manager still doesn't know if spending $50 on Activity 1 by the end of period one is good or bad since he or she doesn't yet know how much work has been performed on Activity 1. The next basic input, earned value, will tell the project manager what percentage of the activity is completed and they will then know how well the project is progressing.

Earned Value (EV)

Earned Value—refers to the cost of work completed on an activity which can be found by multiplying the percentage of completed work for a given activity by the planned value for the same activity.

EV = PV for the Activity × Percentage Complete

One thing to watch out for is that the calculation of EV is not time-dependent; it uses the total PV for an activity, not the value for PV at a certain point in time as found on a time-phased budget. For example, if Activity 1 is 100% complete at the end of period one, then EV = $50 × 100%, or EV = $50 On the other hand, if no progress has been made on this activity (0% complete), then $50 × 0%, or EV = $0.00

Cost Variance (CV)

CV is the first of two basic variances that can be calculated once EV, PV and AC have been determined for an activity or project. CV is simply the Earned Value minus the Actual Costs.

CV = EV − AC

If CV is negative, that means that the project work is costing more than planned. If CV is positive, then the project work is costing less than planned. CV can be calculated for each activity, for segments of a project (for example, a deliverable or sub-deliverable) or for the entire project.

Watch the video, *Calculating and Understanding Cost Variance*, for an explanation of how to calculate and interpret CVs.

Schedule Variance (SV)

SV is the second of two basic variances that can be calculated once EV, PV, and AC have been determined for an activity or project. SV is simply the Earned Value minus the Planned Value.

SV = EV − PV

If SV is negative, that means that less work has been performed than what was planned. If SV is positive, then more work has been done than planned.

Like CV, SV can be calculated for each activity, for segments of a project (for example, a deliverable or sub-deliverable) or for the entire project.

Watch the video *Calculating and Understanding Schedule Variance* for an explanation of how to calculate and interpret SV.

Video: Calculating and Understanding Schedule Variance by Prof C [4:14] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

Cost Performance Index (CPI)

While CV provides a dollar amount that reflects how much over or under the project is at a particular point in time, The **Cost Performance Index (CPI)** provides an indicator of the overall cost performance to date and a good idea of how the project work is trending with regard to cost performance. CPI is calculated as follows:

CPI = EV ÷ AC

- A CPI that is < 1 means that the cost of completing the work is higher than planned.
- A CPI that is = 1 means that the cost of completing the work is right on plan.
- A CPI that is > 1 means that the cost of completing the work is less than planned.

Watch the video *Cost Performance Index (CPI)* for a basic walk-through of CPI calculations and the interpretation of the results.

Video: Cost Performance Index (CPI) by Prof C [3:47] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

Schedule Performance Index (SPI)

While SV provided a dollar amount that reflected well the project is doing at turning dollars into completed activities on schedule, the **Schedule Performance Index (SPI)** provides an indicator of the overall schedule performance to date. Remember that there are some limitations on using money to measure time. Those limitations apply to SPI as well. To know whether a project is really behind or ahead of schedule, a project manager will also look at the planned start and finish dates, milestones, etc.

SPI is calculated as follows:

SPI = EV ÷ PV

- An SPI that is < 1 means that the project is behind schedule.
- An SPI that is = 1 means that the project is on schedule.
- An SPI that is > 1 means that the project is ahead of schedule.

Watch the video *Schedule Performance Index (SPI)* for a basic introduction to SPI calculations and the interpretation of the results.

Video: Schedule Performance Index (SPI) by Prof C [7:09] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

4.6. Project Implementation

Planning, monitoring, and controlling a project's progress is an ongoing project management responsibility. From the beginning of a project, a project manager must decide the type of data that needs to be collected, the analyses the data will undergo, and the formats in which pertinent information will be reported. A project is a system, and information keeps systems moving. To be successful, you need to create an information system that gives the project manager and others the information they need to make informed, timely decisions that will keep project performance close to the plan. The type of information required includes:

Feedback

- Information about progress
- Suggests need to adjust after the outcome is measured
- e.g. Status reports

Feedforward

- Information about choices (options)
- Adjustments made prior to implementing
- e.g. Risk and communication analysis.

Both types of information are useful and necessary for success. Feedback is required to assess actual performance, but it may be too late to make adjustments. Feedforward protects the project from surprises and may reduce turbulence when changes are necessary.

Project managers can design monitoring and controlling systems specially targeted for schedule performance, work effort, and expenditures. Monitoring and managing scope creep and project change are two overarching control responsibilities.

After carefully planning your project, you will be ready to start the project implementation phase, the third phase of the project management life cycle. The **implementation phase** involves putting the project plan into action. Here, the project manager will coordinate and direct project resources to meet the objectives of the project plan. As the project unfolds, it's the project manager's job to direct and manage each activity every step of the way. That's what happens in the implementation phase of the project life cycle: you follow the plan you've put together and handle any problems that come up.

Implementation Phase

The implementation phase is where you and your project team actually do the project work to produce the deliverables. The word "deliverable" means anything your project delivers. The deliverables for your project include all of the products or services that you and your team are performing for the client, customer, or sponsor, including all the project management documents that you put together.

The steps undertaken to build each deliverable will vary depending on the type of project you are undertaking, and they cannot be described here in any real detail. For instance, engineering and telecommunications projects will focus on using equipment, resources, and materials to construct each project deliverable, whereas computer software projects may require the development and implementation of software code routines to

produce each project deliverable. The activities required to build each deliverable will be clearly specified within the project requirements document and project plan.

Your job as a project manager is to direct the work, but you need to do more than deliver the results. You also need to keep track of how well your team performs. The implementation phase keeps the project plan on track with careful monitoring and control processes to ensure the final deliverable meets the acceptance criteria set by the customer. This phase is typically where approved changes are implemented.

Most often, changes are identified by looking at performance and quality control data. Routine performance and quality control measurements should be evaluated on a regular basis throughout the implementation phase. Gathering reports on those measurements will help you determine where the problem is and recommend changes to fix it.

Change Control

When you find a problem, you can't just make a change because it may be too expensive or take too long. You will need to look at how it affects the triple constraint (time, cost, scope) and how it impacts project quality. You will then have to determine if it is worth making the change. If you evaluate the impact of the change and find that it won't have an impact on the project triple constraint, then you can make the change without going through change control. **Change control** is a set of procedures that lets you make changes in an organized way.

Any time you need to make a change to your plan, you must start with a change request. This is a document that either you or the person making the request must complete. Any change to your project must be documented so you can figure out what needs to be done, by when, and by whom.

Once the change request is documented, it is submitted to a change control board. A change control board is a group of people who consider changes for approval. Not every change control system has a board, but most do. The change request could also be submitted to the project sponsor or management for review and approval. Putting the recommended changes through change control will help you evaluate the impact and update all the necessary documents. Not all changes are approved, but if the changes are approved, you send them back to the team to put them in place.

The implementation phase uses the most project time and resources, and as a result, costs are usually the highest during this phase. Project managers also experience the greatest conflicts over schedules in this phase. As you are monitoring your project, you may find that the actual time it takes to do the scheduled work is longer than the amount of planned time.

When you absolutely have to meet the date and you are running behind, you can sometimes find ways to do activities more quickly by adding more resources to critical path tasks. That's called *crashing*. Crashing the schedule means adding resources or moving them around to bring the project back into line with the schedule. Crashing *always* costs more and doesn't always work. There's no way to crash a schedule without raising the overall cost of the project. So, if the budget is fixed and you don't have any extra money to spend, you can't use this technique.

Sometimes, you've got two activities planned to occur in sequence, but you can actually do them at the same time. This is called *fast-tracking* the project. On a software project, you might do both your user acceptance testing (UAT) and your functional testing at the same time, for example. This is pretty risky. There's a good chance you might need to redo some of the work you have done concurrently. Crashing and fast-tracking are

schedule compression tools. Managing a schedule change means keeping all of your schedule documents up to date. That way, you will always be comparing your results to the correct plan.

Status Reporting

After data has been collected and analyzed, it needs to be reported in some form. **Project reports** provide senior management and project teams an opportunity to see whether a project is on track and to determine whether they should do something differently to ensure the projects meet their goals. The fundamental characteristics of a good reporting system include:

Timely, complete and accurate reports

- Not too costly
- Readily acceptable to the team and sponsor
- Containing pertinent information only.
- Warns of pending problems (feedforward)
- Easy to understand – short and concise

In general, project managers should avoid periodic reports except in those cases in which the flow of data is periodic. Reports issued routinely – every day, week, month, or quarter generally do not get read. Instead, let a project's milestones, scope changes, problems, and the project teams's need for information dictate the timing of reports.

Types of Status Reports

- Performance/progress reports –These reports indicate the physical progress to date. The report might include information about procurement, delivery and usage.
- Status reports – These reports identify where we are today and use the information from the performance reports to calculate Schedule Variances (SV) and Cost Variances (CV).
- Projection Reports- The reports provide forward-looking projections and emphasize where the project will end up.
- Exception Reports – These reports identify exceptions, problems, or situations that exceed the threshold limits on items such as variances, cash flows, resources assigned, etc.

After the deliverables have been physically constructed and accepted by the customer, a phase review is carried out to determine whether the project is complete and ready for closure.

4.7. Key Terms

Key Terms

- **Actual Costs:** this refers to the completed work. Is the easiest of the inputs to understand.
- **Cause-and-effect Diagrams** help discover problems based on variation.
- **Change Control**: a set of procedures that lets you make changes in an organized way.
- **Control Charts**: used to define acceptable limits.
- **Cost of Quality**: is what you get when you add up the cost of all the prevention and inspection activities you are going to do on your project.
- **Cost Performance Index (CPI):** provides an indicator of the overall cost performance to date and a good idea of how the project work is trending with regard to cost performance.
- **Cost Variance (CV):** is the first of two basic variances that can be calculated once EV, PV and AC have been determined for an activity or project. CV is simply the Earned Value minus the Actual Costs.
- **Cost-benefit analysis:** is looking at how much your quality activities will cost versus how much you will gain from doing them.
- **Design of Experiments:** is the list of all the kinds of tests you are going to run on your product.
- **Earned Value**: Refers to the cost of work completed on an activity.
- **Earned Value Analysis (EVA):** is a monitoring and controlling process that compares project progress to the project baseline (original plan). EVA measures the performance of a project in terms of cost and schedule.
- **Implementation Phase**: when you and your team actually get to do the project work and generate the deliverables.
- **Planned Value:** Refers to the expected cost that will be spent on the project over its lifetime.
- **Project Reports**: provide senior management and project teams an opportunity to determine a project's status.
- **Quality** is the degree to which a set of inherent characteristics fulfill requirements.
- **Schedule Performance Index (SPI):** provides an indicator of the overall schedule performance to date.
- **Schedule Variance (SV):** is the second of two basic variances that can be calculated once EV, PV, and AC have been determined for an activity or project. SV is simply the Earned Value minus the Planned Value.
- **Statistics**: the mathematical interpretation of numerical data—are useful when interpreting large numbers of measurements and are used to determine how well the product meets a specification when the same product is made repeatedly.
- **Tolerances** are often written as the mean value, plus or minus the tolerance. The plus and minus signs are written together, ±.

CHAPTER 5 - PROJECT MANAGEMENT - THE CLOSURE PHASE

Chapter Overview

5.1. Chapter Introduction

Learning Objectives

By the end of this chapter, you should be able to:

1. Discuss the project closure phase.
2. Explain the value of project reviews and audits.
3. Describe issues related to correcting course mid-project and decisions about terminating a project.
4. Recognize the importance of concluding a project with lessons learned.

5.2. Reasons for Closing Projects

If an audit reveals the painful truth that it's time to terminate a project, then it's important to realize that this is not necessarily a bad thing. Cancelling a project may seem like a failure, but for a project to be successful, it must provide value to all parties. The best value is to minimize the project's overall negative impact on all parties in terms of both time and money. If the only option is to proceed with a scaled-down project, one that delivers late or one that costs significantly more, the result may be worse than cancelling the It may be more prudent to invest the time and resources on an alternate endeavour or to reconstitute the project in the future using a different team and revised parameters. (Williams, 2011)

When considering terminating a project, it's helpful to ask the following questions:

- Has the project been made obsolete or less valuable by technical advances? For instance, this might be the case if you're developing a new cell phone and a competitor releases new technology that makes your product undesirable.
- Given progress to date, updated costs to complete, and the expected value of the project's output, is continuation still cost-effective? Calculations about a project's cost-effectiveness can change over time. What's true at the beginning of the project may not be true a few months later. This is often the case with IT projects, where final costs are often higher than expected.
- Is it time to integrate the project into regular operations? For example, an IT project that involves rolling out a new network system will typically be integrated into regular operations once network users have transitioned to the new system.
- Are there better alternative uses for the funds, time, and personnel devoted to the project? As you learned in Chapter 2, on project selection, the key to successful portfolio management is using scarce resources wisely. This involves making hard choices about the relative benefits of individual projects. This might be an especially important concern in the case of a merger when an organization has to evaluate competing projects and determine which best serves the organization's larger goals.
- Has a strategic inflection point, caused by a change in the market or regulatory requirements, altered the need for the project's output?
- Does anything else about the project suggest the existence of a strategic inflection point—and, therefore a need to reconsider the project's fundamental objectives?

Determining whether to terminate a project can be a very difficult decision for people close to a project to make. Your perspective on a project has a huge effect on your judgment of its overall success. That is why a review conducted by an objective external auditor can be so illuminating.

Common Reasons for Project Termination

- Low profitability and or lowered market potential
- Competing projects become a higher priority
- Severe delays to the schedule
- Change of market needs

- Technical issues that can not be resolved
- Low profitability and or lowered market potential
- Increase in damaging cost
- High uncertainty of technical success or commercial gain

5.3. Contract Closing

Just as a project comes to a close, a contract also comes to a close. **Contract closure** is concerned with completing and settling the terms of the contracts for the project. It supports the project completion process because the contract closure process determines if the work described in the contracts was completed accurately and satisfactorily. Keep in mind that not all projects are performed under contract, so not all projects require the contract closure process. Obviously, this process applies only to those phases, deliverables, or portions of the project that were performed under contract.

Contract closure updates the project records, detailing the final results of the work on the project. Contracts may have specific terms or conditions for completion. You should be aware of these terms or conditions so that project completion isn't held up because you missed an important detail. If you are administering the contract yourself, be sure to ask your procurement department if there are any special conditions that you should be aware of so that your project team doesn't inadvertently delay contract project closure.

One of the purposes of the contract closure process is to provide formal notice to the seller, usually in written form, that the deliverables are acceptable and satisfactory or have been rejected. If the product or service does not meet the expectations, the vendor will need to correct the problems before you issue a formal acceptance notice. Before the contract is closed, any minor items that need to be repaired or completed are placed on a **punch list**, which is a list of all the items found by the client team or manager that still remain to be done.

Hopefully, quality audits have been performed during the course of the project, and the vendor was given the opportunity to make corrections earlier in the process than the closing phase. It's not a good idea to wait until the very end of the project and then spring all the problems and issues on the vendor at once. It's much more efficient to discuss problems with your vendor as the project progresses because it provides the opportunity for correction when the problems occur.

The project team will then work on all of the items on the punch list, building a small schedule to complete the remaining work. If the number of items on the punch list is too large or the amount of work is significant, the project team continues to work on the project. Once the punch list becomes smaller, the project manager begins closing down the project, maintaining only enough staff and equipment to support the team that is working on the punch list.

If the product or service does meet the project's expectations and is acceptable, formal written notice to the seller is required, indicating that the contract is complete. This is the formal acceptance and closure of the contract. It's your responsibility as the project manager to document the formal acceptance of the contract. Many times, the provisions for formalizing acceptance and closing the contract are spelled out in the contract itself.

If you have a procurement department handling the contract administration, they will expect you to inform them when the contract is complete and will in turn follow the formal procedures to let the seller know the contract is complete. However, you will still note the contract completion in your copy of the project records.

Procurement Contracts

The performance of suppliers and vendors is reviewed to determine if they should still be included in the list of qualified suppliers or vendors. The choice of contract for each is reviewed to determine if the decision to share risk was justified and if the choice of incentives worked.

5.4. Releasing the Resources

Releasing the Project Team

Releasing project team members is not an official process. However, it should be noted that at the conclusion of the project, you will release your project team members, and they will go back to their functional managers or get assigned to a new project. You will want to keep their managers, or other project managers, informed as you get closer to project completion so that they have time to adequately plan for the return of their employees. Let them know a few months ahead of time what the schedule looks like and how soon they can plan on using their employees on new projects. This gives the other managers the ability to start planning activities and scheduling activity dates.

Final Payments

The final payment is usually more than a simple percentage of the work that remains to be completed. Completing the project might involve fixing the most difficult problems that are disproportionately expensive to solve, so the final payment should be large enough to motivate the vendor to give the project a high priority so that the project can be completed on time.

If the supplier has met all the contractual obligations, including fixing problems and making repairs as noted on a punch list, the project team signs off on the contract and submits it to the accounting department for final payment. The supplier is notified that the last payment is final and completes the contractual agreement with the project.

5.5. Lesson Learned

Project closure is traditionally considered the final phase of a project. It includes tasks such as

- Transferring deliverables to the customer
- Cancelling supplier contracts
- Reassigning staff, equipment, and other resources
- Finalizing project documentation by adding an analysis summarizing the project's ups and downs
- Making the documentation accessible to other people in your organization as a reference for future projects
- Holding a close-out meeting
- Celebrating the completed project

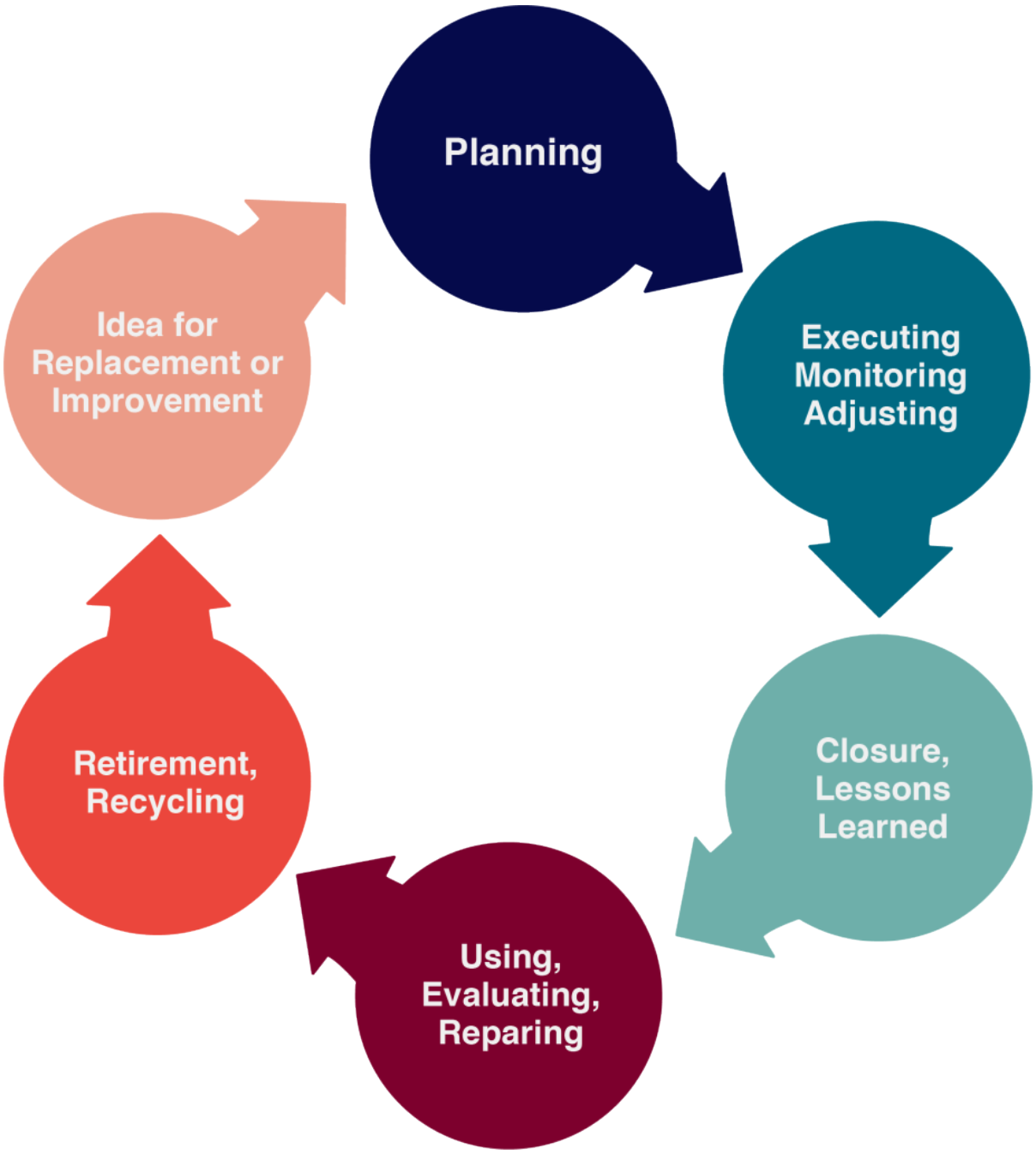

Figure 5.1: Seen from a living order perspective, closure is an extension of the learning and adjusting process that goes on throughout a project.

The Close-Out Meeting is an opportunity to end a project the way you started it—by getting the team together. During this important event, the team should review what went well and what didn't go well and identify areas for improvement. All of this should be summarized in the final close-out report. A final close-out meeting with the customer is also essential. This allows the organization to formally complete the project and lay the groundwork for potential future work.

The Close-Out Report provides a final summary of the project performance. It should include the following:

- Summary of the project and deliverables
- Data on performance related to schedule, cost, and quality
- Summary of the final product, service, or project and how it supports the organization's business goals
- Risks encountered and how they were mitigated
- Lessons learned

Exactly where your work falls in the project's life cycle depends on your perspective as to what constitutes "the project" in the first place. The designers and constructors of a building might consider the acceptance of the building by the owner as project closure. However, the results of the project—that is, the building—live on. Another contractor might be hired later to modify the building or one of its systems, thus starting a new project limited to that work.

If project closure is done thoughtfully and systematically, it can help ensure a smooth transition to the next stage of the project's life cycle or to subsequent related projects. A well-done project closure can also generate useful lessons learned that can have far-reaching ramifications for future projects and business sustainability. The closeout information at the end of a project should always form the basis of initial planning for any similar projects in the future.

Although most project managers spend time and resources on planning for project start-up, they tend to neglect the proper planning required for project closure. Ideally, project closure includes documentation of results, transferring responsibility, reassignment of personnel and other resources, closing out work orders, preparing for financial payments, and evaluating customer satisfaction. Of course, less complicated projects will require a less complicated close-out procedure. As with project audits, the smooth unfolding of the project closure phase depends to a great degree on the manager's ability to handle personnel issues thoughtfully and sensitively. In large, ongoing projects, the team may conduct phase closures at the end of significant phases in addition to a culminating project closure.

5.6. Key Terms

Key Terms

- **Close-Out Meeting:** is an opportunity to end a project the way you started it—by getting the team together. During this important event, the team should review what went well and what didn't go well and identify areas for improvement.
- **Close-Out Report:** provides a final summary of the project performance.
- **Contract Closure:** Concerned with completing and settling the terms of the contracts for the project. It supports the project completion process because the contract closure process determines if the work described in the contracts was completed accurately and satisfactorily.
- **Project Closure:** is traditionally considered the final phase of a project.
- **Punch List:** List of issues/items that require immediate attention and building a small schedule to complete the remaining work.

CHAPTER 6 EVENT PLANNING - RISK MANAGEMENT

Chapter Overview

6.1. Chapter Introduction

Learning Objectives

After reading this chapter, you will be able to:

1. Define the concepts of risk and risk management.
2. Explain the process of risk identification, evaluation and mitigation.
3. Identify types of risks based on the project phases.
4. Explain the benefits of a contingency plan.
5. Explain the rights and responsibilities of the employee, employer, and supervisor regarding Occupational Health & Safety in Ontario.

6.2. Risk Management

Risk is potential loss or harm (Canadian Tourism Commission [CTC], 2003a). This could be a financial loss, damage to property, or injury to workers or guests.

Risk management refers to the process of identifying, quantifying, and managing the risks that an organization faces. These may vary significantly depending on the type of operation and the industry undertaking the risk management process. Consequently, it is helpful to think of risk management as being a process of determining the risk exposure and then initiating action to either minimize or eliminate the risk (Enterprise Risk Management, 2004).

Why Practise Risk Management?

There are two main reasons to practise risk management: to avoid injury, and to protect business operations from financial or physical ruin.

Keeping guests and employees safe is a moral and ethical responsibility of operators and includes avoiding emotional and physical harm. Protecting business operations includes protecting against damage to property, damage to reputation, and any financial impacts occurring from litigation (Centre for Curriculum, Transfer, and Technology [CCTT], 2003a). By practising this twofold approach, operators demonstrate that they are prioritizing the health and safety of individuals while still taking steps to protect the operational sustainability of their company.

On a larger scale, practising effective risk management can be seen as an important business skill. The Canadian Tourism Commission (2003a) suggests that risk management:

- Reduces the likelihood of an unwanted and unplanned event
- Reduces the consequences of the event
- Enhances your ability to access comprehensive and cost-effective insurance

Risk management can be undertaken at any scale. Individuals, companies, societies, communities, cities, regions, and even governments can follow the process in order to protect themselves from risks, which may range from company-specific risks, such as disruption of revenue to significant international risks, such as climate change and civil disturbances.

Some risk management initiatives are easier than others; they are required by law and enforced by government agencies. For example, companies providing public transportation (such as passenger transport in a bus) have clearly defined requirements as set out by their local motor vehicle branch in government. They are required to use appropriately licensed drivers, submit to commercial vehicle inspections, and insure their vehicles as required. Failing to adhere to these standards may result in suspension of operating privileges, fines, or even imprisonment.

However, other aspects of risk management are not regulated so extensively. This is characteristic of the majority of tourism and hospitality activities offered in Canada today. Operators offer services to the general public and self-regulate in terms of safety. If injury to a guest occurs, and that guest feels that he or she has grounds for a financial claim, that person can initiate a lawsuit against the tourism operator. If this claim is found valid in court, then the tourism operator may have to pay a large financial settlement to that claimant.

In short, tour operators must comply with applicable statutory requirements and be sure to self-monitor to determine if the standard that they are operating at is acceptable to society and their peers. Failing to do so may result in a range of consequences, including fines, suspension of operations, or a lawsuit. Clearly, risk management for tourism and hospitality is a complicated process.

Concepts of Risk

Before we examine the risk management process, let's look at three theoretical concepts of risk: real risk, perceived risk, and inherent risk.

- *Real risk* is the actual statistical likelihood of an incident occurring. This is established through reviews of statistics and other relevant data, and by an analytical process and use of expertise in the field. There is little ambiguity or subjectivity in real risk (CTC, 2003a).
- *Perceived risk* is the perception of risk by those undertaking or evaluating something; it may vary greatly based on their level of apprehension, anxiety, or experience with the specific risk. Perceived risk can also vary greatly from the real risk of an activity; it can be higher or lower than the actual risk. Successful management of perceived risk may include operators promoting the risk of activity as high, even if, in reality, the risk is minimal. This strategy can ensure the successful delivery of an exhilarating, challenging experience while remaining safety conscious (Dowling, 1986).
- *Inherent risk* is the risk that must exist for the activity to occur; examples include the risk of drowning when swimming and the risk of falling during skiing. It is impossible to eliminate inherent risk from these activities because it would preclude participating in them. However, operators should take steps to minimize inherent risk; this could include, for example, providing appropriate safety equipment for guests, training staff, and informing participants of the hazards of the activity (CCTC, 2003b).

6.3. Risk Identification and Evaluation

Managing risks on projects is a process that includes risk assessment and a mitigation strategy for those risks. **Risk assessment** includes both the identification of potential risks and the evaluation of the possible impact of the risk. A **risk mitigation plan** is designed to eliminate or minimize the impact of the risk events—occurrences that hurt the project. Identifying risk is both a creative and a disciplined process. The creative process includes brainstorming sessions where the team is asked to list everything that could go wrong. All ideas are welcome at this stage, and the evaluation of the ideas will come later.

Risk Identification

A more disciplined process involves using checklists of potential risks and evaluating the likelihood that those events might happen to the project. Some companies and industries develop risk checklists based on experience from past projects. These checklists can be helpful to the project manager and project team in identifying specific risks on the checklist and expanding the team's thinking. The past experience of the project team, project experience within the company, and experts in the industry can be valuable resources for identifying potential risks on a project.

Identifying the sources of risk by category is another method for exploring potential risks in a project. Some examples of categories for potential risks include the following:

- Technical
- Cost
- Schedule
- Client
- Contractual
- Weather
- Financial
- Political
- Environmental
- People

You can use the same framework as the work breakdown structure (WBS) to develop a risk breakdown structure (RBS). A risk breakdown structure organizes the risks that have been identified into categories using a table with increasing levels of detail to the right. The people category can be subdivided into different types of risks associated with the people. Examples of people risks include not finding people with the skills needed to execute the project or the sudden unavailability of key people.

Example: Risks in John's Move

In John's move, John makes a list of things that might go wrong with his project and uses his work

breakdown structure as a guide. A partial list for the planning portion of the RBS is shown in Table 9.1. The result is a clearer understanding of where risks are most concentrated. This approach helps the project team identify known risks but can be restrictive and less creative in identifying unknown risks and risks not easily found inside the WBS.

Table 6.1 Risk Breakdown Structure (RBS)

Level 1	Level 2	Level 3
Plan Move	Contact Dion and Carlita	Dion backs out
		Carlita backs out
		No common date available
	Host Planning Lunch	Restaurant full or closed
		Wrong choice of ethnics food
		Dion or Carlita have special food allergies preferences
	Develop and Distribute Schedule	Printer out of toner
		Out of paper

Risk Evaluation

After identifying the potential risks, the project team evaluates each risk based on the probability that a risk event will occur and its possible loss. Not all risks are equal. Some risk events are more likely to happen than others, and the cost of a risk can vary greatly. Evaluating the risk for the probability of occurrence and the severity or the potential loss to the project is the next step in the risk management process.

Having criteria to determine high-impact risks can help narrow the focus on a few critical risks that require mitigation. For example, suppose high-impact risks could increase the project costs by 5% of the conceptual budget or 2% of the detailed budget. Only a few potential risk events meet these criteria. These are the critical potential risk events that the project management team should focus on when developing a project risk mitigation or management plan. Risk evaluation is about developing an understanding of which potential risks have the greatest possibility of occurring and can have the greatest negative impact on the project (Figure 6.1). These become the critical few.

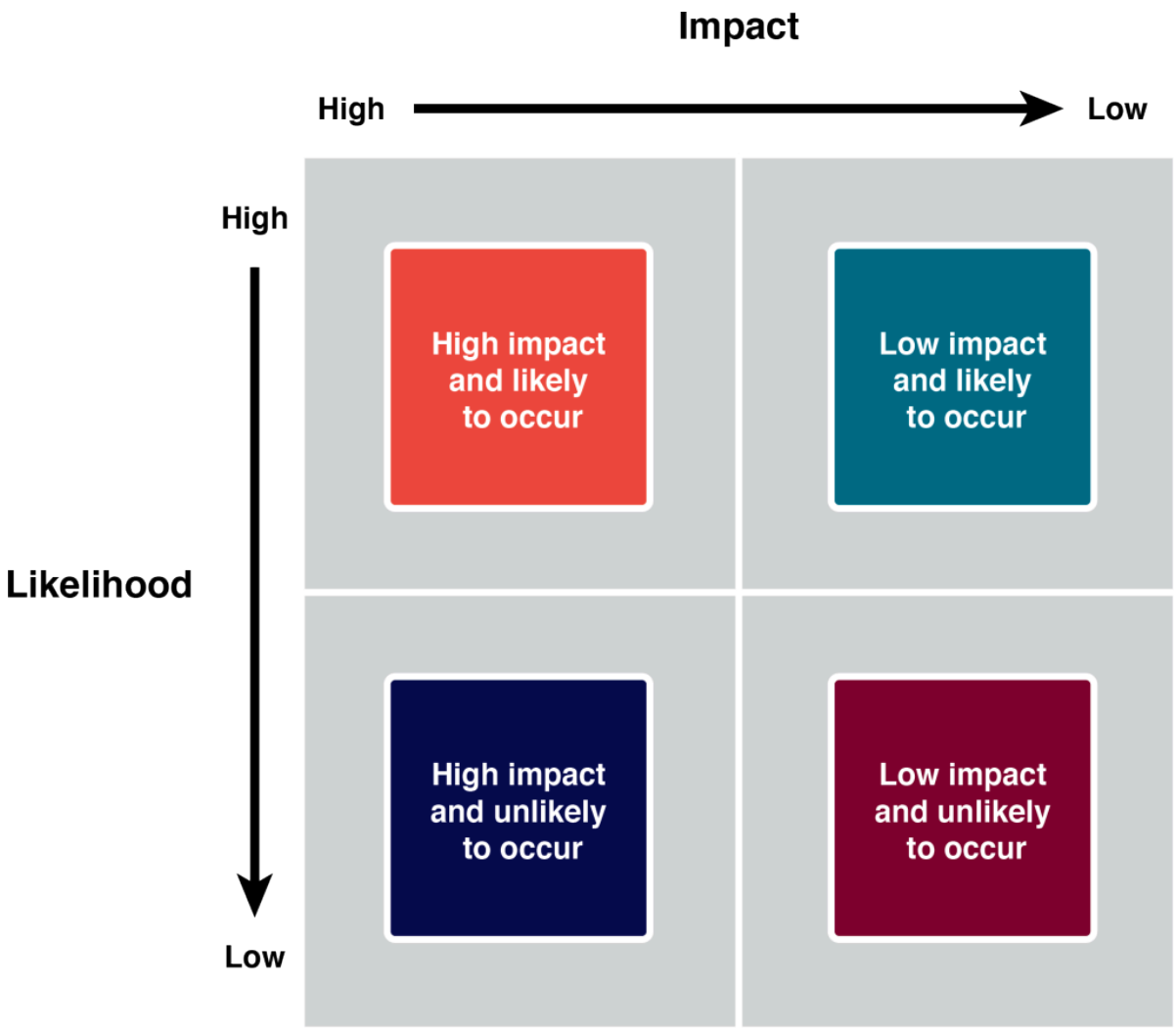

Figure 6.1: Risk and Impact

There is a positive correlation—both increase or decrease together—between project risk and project complexity. A project with new and emerging technology will have a high complexity rating and a correspondingly high risk. The project management team will assign the appropriate resources to the technology managers to ensure the accomplishment of project goals. The more complex the technology, the more resources the technology manager typically needs to meet project goals, and each of those resources could face unexpected problems.

Risk evaluation often occurs in a workshop setting. Building on identifying the risks, each risk event is analyzed to determine the likelihood of occurrence and the potential cost if it did occur. The likelihood and impact are rated high, medium, or low. A risk mitigation plan addresses the items with high ratings on both likelihood and impact.

Engineers are trained to use risk management tools like the risk matrix shown in Figure 6.2, in which the probability of the risk is multiplied by the severity of consequences if the risk does indeed materialize.

PROBABILITY		IMPACT				
		A	B	C	D	E
		Negligible	Minor	Moderate	Major	Severe
E	Very Likely	Low Medium	Medium	Medium High	High	High
D	Likely	Low	Low Medium	Medium	Medium High	High
C	Possible	Low	Low Medium	Medium	Medium High	Medium High
B	Unlikely	Low	Low Medium	Low Medium	Medium	Medium High
A	Very Unlikely	Low	Low	Low Medium	Medium	Medium

Figure 6.2: A risk matrix is a tool engineers often use to manage risk

This and other risk management tools can be useful because they provide an objective framework for evaluating the seriousness of risks to your project. However, any risk assessment tool can do more harm than good if it lulls you into a false sense of security, so you make the mistake of believing you have foreseen every possible risk that might befall your project. You don't want to make the mistake of believing that the tools available for managing risk can ever be as precise as the tools we use for managing budgets and schedules, even as limited as those tools are.

Perhaps the most important risk management tool is your ability to learn about the project. The more you know about a project, the better you will be at foreseeing the many ways the project could go awry and what the consequences will be if they do, and the better you will be at responding to unexpected challenges.

Example: Risk Analysis of Equipment Delivery

A project team analyzed the risk of some vital equipment not arriving on time for the project. The team identified three pieces of equipment that were critical to the project and would significantly increase costs if they were late in arriving. One of the vendors, who was selected to deliver an important piece of equipment, had a history of being late on other projects. The vendor was good and often took on more work than it could deliver on time. This risk event (the identified equipment arriving late) was rated as high likelihood of a high impact. The other two pieces of equipment had a high impact on the project but with a low probability of occurring.

Not all project managers conduct a formal risk assessment on a project. One reason, as found by David Parker and Alison Mobey in their phenomenological study of project managers, was a low understanding of the tools and benefits of a structured analysis of project risks (Parker & Mobey, 2004). The lack of formal risk management tools was also seen as a barrier to implementing a risk management program. Additionally, the project manager's personality and management style play into risk preparation levels. Some project managers are more proactive and develop elaborate risk management programs for their projects. Other managers are

reactive and are more confident in their ability to handle unexpected events when they occur. Yet others are risk averse and prefer to be optimistic and not consider risks or avoid taking risks whenever possible.

On projects with a low-complexity profile, the project manager may informally track items considered risk items. On more complex projects, the project management team may develop a list of items perceived to be higher risk and track them during project reviews. On projects of even greater complexity, the process for evaluating risk is more formal with a risk assessment meeting or series of meetings during the project's life to assess risks at different phases. On highly complex projects, an outside expert may be included in the risk assessment process, and the risk assessment plan may take a more prominent place in the project implementation plan.

Generally, for complex projects, statistical models are sometimes used to evaluate risk because there are too many different possible combinations of risks to calculate them one at a time. One example of the statistical model used on projects is the Monte Carlo simulation, which simulates a possible range of outcomes by trying many different combinations of risks based on their likelihood. The output from a Monte Carlo simulation provides the project team with the probability of an event occurring within a range and for combinations of events. For example, the typical output from a Monte Carlo simulation may indicate a 10% chance that one of the three important pieces of equipment will be late and that the weather will also be unusually bad after the equipment arrives.

6.4. Risk Mitigation

Risk Mitigation

After the risk has been identified and evaluated, the project team develops a risk mitigation plan, which is a plan to reduce the impact of an unexpected event. The project team mitigates risks in various ways:

- Risk avoidance
- Risk sharing
- Risk reduction
- Risk transfer

Each of these mitigation techniques can be an effective tool in reducing individual risks and the risk profile of the project. The risk mitigation plan captures the risk mitigation approach for each identified risk event and the actions the project management team will take to reduce or eliminate the risk.

Risk Avoidance usually involves developing an alternative strategy that has a higher probability of success but usually at a higher cost associated with accomplishing a project task. A common risk avoidance technique is to use proven and existing technologies rather than adopt new techniques, even though the new techniques may show promise of better performance or lower costs. A project team may choose a vendor with a proven track record over a new vendor that is providing significant price incentives to avoid the risk of working with a new vendor. The project team that requires drug testing for team members is practicing risk avoidance by avoiding damage done by someone under the influence of drugs.

Risk Sharing involves partnering with others to share responsibility for risky activities. Many organizations that work on international projects will reduce political, legal, labour, and other risk types associated with international projects by developing a joint venture with a company located in that country. Partnering with another company to share the risk associated with a portion of the project is advantageous when the other company has the expertise and experience the project team does not have. If a risk event does occur, then the partnering company absorbs some or all of the negative impact of the event. The company will also derive some of the profit or benefit gained by a successful project.

Risk Reduction is an investment of funds to reduce the risk of a project. For international projects, companies will often purchase a currency rate guarantee to reduce the risk associated with fluctuations in the currency exchange rate. A project manager may hire an expert to review a project's technical plans or cost estimates to increase confidence in that plan and reduce the project risk. Assigning highly skilled project personnel to manage high-risk activities is another risk-reduction method. Experts managing a high-risk activity can often predict problems and find solutions that prevent the activities from having a negative impact on the project. Some companies reduce risk by forbidding key executives or technology experts to ride on the same airplane.

Risk Transfer is a risk reduction method that shifts the risk from the project to another party. The purchase of insurance on certain items is a risk-transfer method. The risk is transferred from the project to the insurance company. A construction project in the Caribbean may purchase hurricane insurance that would cover the cost of a hurricane damaging the construction site. The purchase of insurance is usually in areas outside the control of the project team. Weather, political unrest, and labour strikes are examples of events that can significantly impact the project and that are outside the control of the project team.

6.5. Risks in Project Phases

Project risk is dealt with in different ways depending on the phase of the project.

Initiation

Risk is associated with things that are unknown. More things are unknown at the beginning of a project, but risk must be considered in the initiation phase and weighed against the potential benefit of the project's success in order to decide if the project should be chosen.

Example: Risks by Phase in John's Move

In the initiation phase of his move, John considers the risk of events that could affect the whole project. Let's assume that John's move is not just about changing jobs but also a change of cities. This would certainly incur more risks for the project. He identifies the following risks during the initiation phase that might have a high impact and rates the likelihood of their happening from low to high.

1. His new employer might change his mind and take back the job offer after he's given notice at his old job: Low.
2. The current tenants of his apartment might not move out in time for him to move in by the first day of work at the new job: Medium.
3. The movers might lose his furniture: Low.
4. The movers might be more than a week late delivering his furniture: Medium.
5. He might get in an accident driving from Chicago to Atlanta and miss starting his job: Low.

John considers how to mitigate each of the risks.

1. During his job hunt, John had more than one offer, and he was confident that he could get another job, but he might lose deposit money on the apartment and the mover. He would also lose wages during the time it took to find the other job. To mitigate the risk of his new employer changing his mind, John makes sure that he keeps his relationships with his alternate employers cordial and writes to each of them, thanking them for their consideration in his recent interviews.
2. John checks the market in Atlanta to determine the weekly cost and availability of extended-stay motels.
3. John checks the mover's contract to confirm that they carry insurance against lost items, but they require the owner to provide a detailed list with value estimates and they limit the maximum total value. John decides to go through his apartment with his digital camera and take pictures of all of his possessions that will be shipped by truck and to keep the camera with him during the move so he has a visual record and won't have to rely on his memory to make a list. He seals and numbers the boxes so he can tell if a box is missing.
4. If the movers are late, John can use his research on extended-stay motels to calculate how much

it would cost. He checks the moving company's contract to see if they compensate the owner for late delivery, and he finds that they do not.

5. John checks the estimated driving time from Chicago to Atlanta using an Internet mapping service and gets an estimate of 11 hours of driving time. He decides that it would be too risky to attempt to make the drive by himself in one day, especially if he didn't leave until after the truck was packed. John plans to spend one night on the road in a motel to reduce the risk of an accident caused by driving while too tired.

John concludes that the medium risks can be mitigated, and the costs from the mitigation would be acceptable in order to get a new job.

Planning Phase

Once the project is approved and it moves into the planning stage, risks are identified with each major group of activities. A risk breakdown structure (RBS) can be used to identify increasing levels of detailed risk analysis.

Table 6.2 Risk Breakdown Structure (RBS) for Packing John's Apartment

Level 1	Level 2	Level 3 – Risks	Mitigation
Packing	Pack Kitchen	Cuts from handling sharp knives	Buy small boxes for packing knives (RR)
		Cuts from cracked glasses that break while being packed	Discard cracked glass (RA)
		Transporting alcoholic beverages	Give open bottles to Dion or Carlita (RA)
	Pack Living Room	Damage to antique furniture	Supervise wrapping and loading personally (RR) and require movers to insure against damage (RT)
		Lose parts while taking apart the entertainment centre	Buy a box of large freezer bags with a marker to bag and label parts (RR)
		Break most valuable electronics – TV, DVD, Tuner, Speakers	Buy boxes of the right size with sufficient bubble wrap (RR)
	Pack bedroom	Broken mirror	Buy or rent a mirror box with Styrofoam blacks at each corner (RR)
		Lose prescription drugs or pack them where they cannot be found quickly	Separate prescription drugs from transportation in the car (RA)
	Pack Remaining Items	Damage to house plants	Ask Carlita to care for them and bring them with her in the van when she visits in exchange for half of them (RS)
		Transportation of flammable liquids from charcoal grill	Give to Dion or Carlita (RA)
Legend: *RA* – Risk Avoidance; *RS*– Risk Sharing; *RR* – Risk Reduction; *RT* – Risk Transfer			

John decides to ask Dion and Carlita for their help during their first planning meeting to identify risks, rate their impact and likelihood, and suggest mitigation plans. They concentrate on the packing phase of the move. They fill out a table of risks, as shown in Table 6.2.

Implementation Phase

As the project progresses and more information becomes available to the project team, the total risk on the project typically reduces as activities are performed without loss. The risk plan needs to be updated with new information, and risks related to activities that have been performed must be checked off.

Understanding where the risks occur on the project is important information for managing the contingency budget and managing cash reserves. Most organizations develop a plan for financing the project from existing organizational resources, including financing the project through a variety of financial instruments. In most cases, there is a cost to the organization to keep these funds available to the project, including the contingency budget. As the risks decrease over the length of the project, if the contingency is not used, then the funds set aside by the organization can be used for other purposes.

To determine the amount of contingency that can be released, the project team will conduct another risk evaluation and determine the amount of risk remaining on the project. If the risk profile is lower, the project team may release contingency funds back to the parent organization. If additional risks are uncovered, a new mitigation plan is developed, including the possible addition of contingency funds.

Closeout Phase

During the closeout phase, agreements for risk sharing and risk transfer need to be concluded, and the risk breakdown structure must be examined to ensure all the risk events have been avoided or mitigated. The final estimate of loss due to risk can be made and recorded as part of the project documentation. If a Monte Carlo simulation is done, the result can be compared to the predicted result.

6.6. Contingency Planning

The project risk plan balances the investment of the mitigation against the benefit of the project. The project team often develops an alternative method for accomplishing a project goal when a risk event has been identified that may frustrate the accomplishment of that goal. These plans are called **contingency plans**. The risk of a truck driver's strike may be mitigated with a contingency plan that uses a train to transport the needed equipment for the project. If a critical piece of equipment is late, the impact on the schedule can be mitigated by making changes to the schedule to accommodate a late equipment delivery.

Contingency funds are funds set aside by the project team to address unforeseen events that cause the project costs to increase. Projects with a high-risk profile will typically have a large contingency budget. Although the amount of contingency allocated in the project budget is a function of the risks identified in the risk analysis process, contingency is typically managed as one line item in the project budget.

Some project managers allocate the contingency budget to the items in the budget that have high risk rather than developing one line item in the budget for contingencies. This approach allows the project team to track the use of contingency against the risk plan. This approach also allocates the responsibility to manage the risk budget to the managers responsible for those line items. The availability of contingency funds in the line item budget may also increase the use of contingency funds to solve problems rather than finding alternative, less costly solutions. Most project managers, especially on more complex projects, manage contingency funds at the project level, with the project manager's approval required before contingency funds can be used.

6.7. Occupational Health and Safety

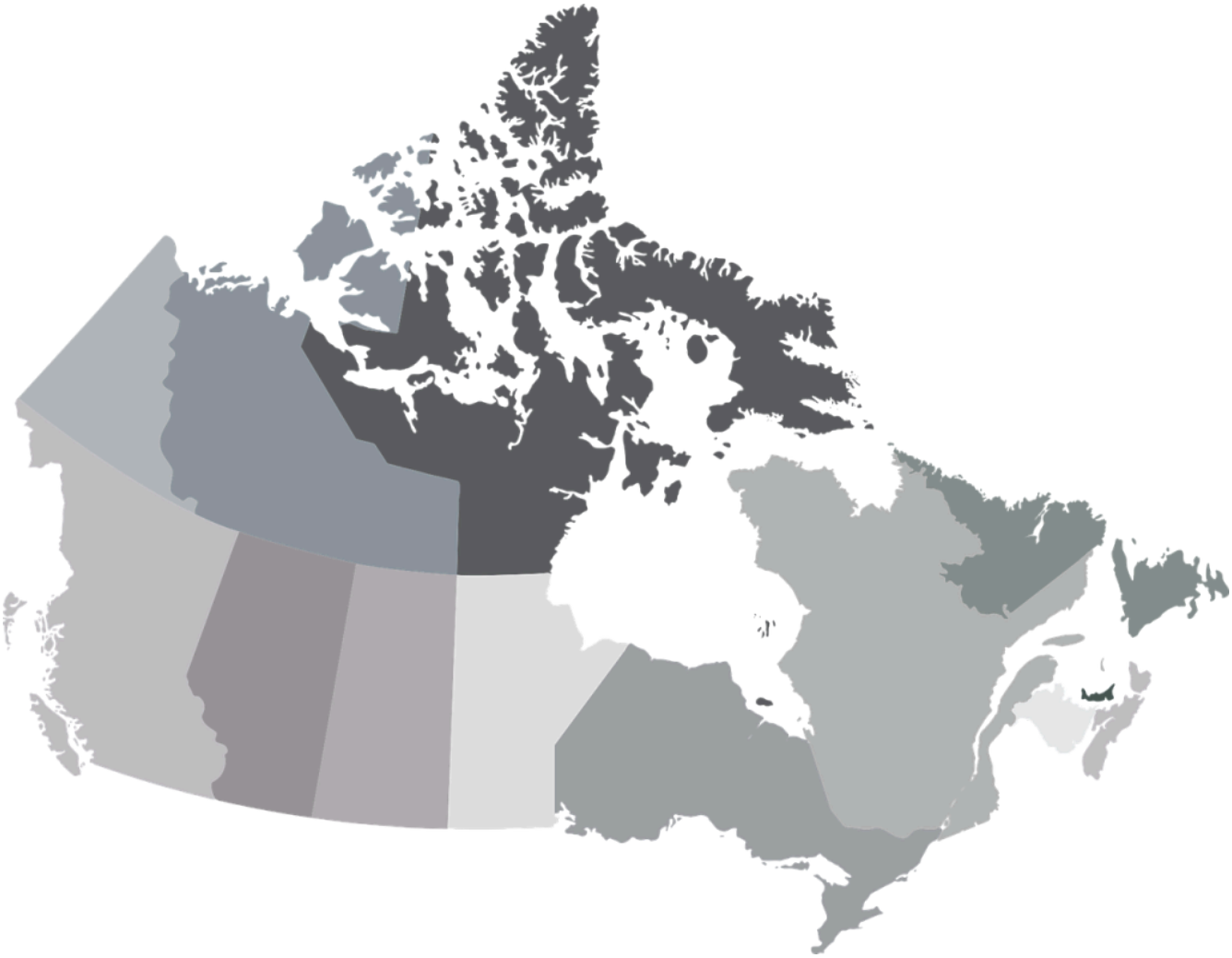

Image by Craig Clark, Pixabay License

All 14 of Canada's jurisdictions have occupational health and safety legislation—laws that grant rights to and impose duties upon workers and employers in order to reduce the level of workplace injury. In this chapter, we will review the responsibilities and the rights of workers, the legal implications of the legislation, and the relationship between safety laws and other pieces of legislation.

Beginning in the 1970s, the federal, provincial, and territorial governments enacted legislation that regulated occupational health and safety (OHS). The distribution of powers under the Canadian constitution means Canada has 14 jurisdictions (federal, ten provincial, and three territorial) regarding health and safety laws. Most employers and workers are covered by the occupational health and safety law of the province or territory in which they work. About 10% of the workforce is, however, covered by the occupational health and safety provisions in the federal government's Canada Labour Code. The Canada Labour Code covers employees of the federal government. It also covers workers in industries that are, by their nature, interprovincial, such as

banking, telecommunications, interprovincial transport, and uranium mining. Each jurisdiction has its own amalgam of acts, regulations, policies, and guidelines.

An **act** is a federal, provincial, or territorial law that sets out the broad legal framework around occupational health and safety in each jurisdiction.

A **regulation** typically sets out how the general principles of the Act will be applied in specific circumstances and is enforceable. Guidelines and policies are more specific rules about occupational health and safety. Other supporting guidance can be found in standards and codes. These documents provide employers with direction on health and safety implementation in the workplace. An example would be CSA Z795-03, which refers to the Coding of Work Injury or Disease Information and is published by the Canadian Standard Association (CSA).

For information specific to Ontario, watch this video below.

Video: "Safety Tips: Who is covered by the Occupational Health and Safety Act in Ontario? by Workplace Safety and Prevention Services [0:56] is licensed under the Standard YouTube License. Captions and transcripts are available on YouTube.

6.8. Key Terms

Key Terms

- **Act**: A federal, provincial, or territorial law that sets out the broad legal framework around occupational health and safety in each jurisdiction.
- **Contingency Plans:** The project risk plan balances the investment of the mitigation against the benefit for the project. The project team often develops an alternative method for accomplishing a project goal when a risk event has been identified that may frustrate the accomplishment of that goal.
- **Regulation:** Determines how the general principles of the Act will be applied and enforced.
- **Risk** is potential loss or harm (Canadian Tourism Commission [CTC], 2003a). This could be a financial loss, damage to property, or injury to workers or guests.
- **Risk assessment** includes both the identification of potential risks and the evaluation of the possible impact of the risk. A **risk mitigation plan** is designed to eliminate or minimize the impact of the risk events—occurrences that hurt the project.
- **Risk Avoidance:** This usually involves developing an alternative strategy that has a higher probability of success but usually at a higher cost associated with accomplishing a project task.
- **Risk Management:** The process of identifying, quantifying, and managing the risks that an organization faces.
- **Risk Reduction:** This is an investment of funds to reduce the risk on a project. On international projects, companies will often purchase the guarantee of a currency rate to reduce the risk associated with fluctuations in the currency exchange rate.
- **Risk Sharing:** Involves partnering with others to share responsibility for risky activities. Or, hiring someone else to take on that part of the project.
- **Risk Transfer:** A risk reduction method that shifts the risk from the project to another party. The purchase of insurance on certain items is a risk-transfer method.

6.9. Case Study: Fit Dads!

Overview

Fit Dads is a membership-based online community for fathers on the move. They had a healthy user base and were influential in the sector. Vendors advertised on their site regularly, and users actively engaged with each other monthly or weekly. The site offered member discounts at participating businesses, giving them another reason to log in regularly. Fit Dads was ready to leap from an online community to an in-person pop-up event in which multiple vendors and members would meet in one place. Organic produce farmers, health-industry vendors, exercise equipment makers, and a host of others were ready and eager to join in on the potential event, but Fit Dads had yet to research the legal requirements for such an event.

Solution

The pop-up event was meant to incorporate experiential and transactional elements, so Fit Dads wanted to ensure that it ran seamlessly and without any problems. They contacted their local government, checked online, and reached out to a lawyer to first determine what legal considerations they needed to understand and where to get the permits and insurance required. Fit Dads acted as the event organizers and were granted usage rights to the space they needed by the landlord via a short-term lease agreement. Fit Dads then signed participation agreements with each vendor. Commercial public liability insurance coverage was acquired by Fit Dads for the event overall, but each vendor also had to get their own insurance for specific areas of coverage. Food safety and other regulatory concerns were reviewed by each vendor and Fit Dad's own lawyer to ensure that nothing was overlooked.

Result

The event succeeded, with each vendor recording sales above their early predictions. No major incidents occurred, and the visitors had a great time seeing all the different products and services for sale. The event helped Fit Dads' online community grow and started fostering demand for more pop-up events. Fit Dads also noted that they could tailor the mix and variety of vendors to each future pop-up location in an effort to match the interests and needs of customers in specific markets.

Questions

Please answer the following questions:

1. If you wanted to open a pop-up shop that sells baked goods, what legal or regulatory considerations do you think are important?
2. List three types of insurance the vendors with shops in Fit Dads' event would not necessarily need to have and explain why.

Version History

This page provides a record of changes made to the open textbook since its initial publication. If the change is minor, the version number increases by 0.1. If the change involves substantial updates, the version number increases to the next full number.

Version	Date	Change	Affected Web Rage
1.0	April 10 2024	Publication	N/A

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